Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER AND AMERICAN ELECTRICIAN.

VOL. LVI. NEW YORK, THURSDAY, NOVEMBER 3, 1910. No. 18.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK

JAMES H. McGRAW, President.
HUGH M. WILSON, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.
TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITOR.....W. D. WEAVER
A. S. M'ALLISTER.....Associate Editor
W. H. ONKEN, JR.....Associate Editor
W. E. KEILY.....Associate Editor
O. H. CALDWELL.....Assistant Editor
W. M. FINLEY.....News Editor
S. S. BOIES.....News Editor
FREDERIC NICHOLAS.....Special Contributor
J. R. CRAVATH.....Special Contributor

CHICAGO OFFICE.....1570 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All Other Countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

Copyright, 1910, by McGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1909 *was* 945,850. *Of this issue,* 22,000 *copies are printed.*

NEW YORK, THURSDAY, NOVEMBER 3, 1910.

CONTENTS.

Editorials 1035
Illuminating Engineering Lecture and Laboratory Course..... 1040
Montreal Lighting Controversy..... 1040
New York Electrical Society Meeting..... 1040
The Metric System and Export Trade with European Continental Countries 1041
Electrical Developments in China..... 1041
Average Income of Technical Graduates..... 1042
Conservation Without Development..... 1042
The Patents of Thomas Alva Edison. By Joseph J. O'Brien..... 1042
Grounding in Mines..... 1043
Hunting of Synchronous Apparatus..... 1044
Illinois State Electric Association Convention..... 1045
The Rate and Accounting Questions at the Illinois Convention..... 1047
Discussion on Rate Schedules at Empire State Meeting..... 1048
Commission News..... 1051
American Electrical Engineers. G. W. Pickard..... 1052
Current News and Notes..... 1053
Interconnected Massachusetts Generating Plants..... 1057
Low-Head Water Power at Manhattan, Kan..... 1061
The Boilerless Steam Central Station at Kenosha, Wis..... 1062
Office Building Power Plant..... 1063
A Large Electric Vehicle Garage at Toledo, Ohio..... 1064
Construction of Foundations for Electrical Machinery. By Bruce H. Page..... 1066
Most Economical Methods of Carrying Peak Loads..... 1068
Letters on Practical Subjects..... 1069
Questions and Answers..... 1073
New England N. E. L. A. Section Active..... 1074
Informal Edison Luncheon Club at Boston..... 1074
Changes in New York City Electrical Code..... 1074
Central-Station Float in Rochester Industrial Parade..... 1075
Table of Costs for House Wiring..... 1075
Co-operative Industrial Development at Boston..... 1076
Small Plant Failures and a Cause for Them. By Charles T. Johnson. 1076
Electric House to Be Exhibited by Boston Edison Company..... 1076
Central-Station Rate Schedules for Retail Customers. By A. C. Einstein 1077
Lighting of the Burlington Arcade..... 1079
Practical Value of Illuminating Engineering..... 1080
LETTERS TO THE EDITOR:
Converter Substations. By A. K. Miller..... 1082
Arc vs. Tungsten Lamps for Indirect Illumination. By Ward Harrison 1082
Bedding of Wire in Magnet Coils. By Cecil P. Poole..... 1083
Digest of Current Electrical Literature..... 1083
New Apparatus and Appliances..... 1088
Industrial and Commercial News..... 1092
General News..... 1096
Directory of Electrical Associations, Societies, etc..... 1104
Weekly Record of Electrical Patents..... 1105

ILLUMINATING ENGINEERING CONVENTION AND LECTURES.

The Illuminating Engineering Society is again to be congratulated on its well-directed activity, as most recently exemplified by the success of its Baltimore convention and the remarkable enrolment for the Johns Hopkins University lectures on illuminating engineering, which course was established through the initiative of the society. A noteworthy feature of the Baltimore convention papers was the direct application of the material presented to general illuminating engineering rather than merely to gas lighting or electric lighting. Of the twelve papers and addresses, only two were of limited applicability, one dealing solely with gas lamps and the other with the electric lighting business, while even these contained much matter of general rather than specific interest. To the broadening effect of papers such as those presented at the convention can be attributed a portion of the widening influence of the society as a national organization. In many respects the semi-public exercises connected with the convention and lecture course can be regarded as affording convincing proof that the cause for which the society stands is beginning to receive in general the recognition which it merits. However circumscribed the original field of the society may have been held to be, it now appears to be reaching out on the one side to co-operate with the ophthalmologist, and on the other to render assistance to the architect and contractor. Doubtless the ultimate detrimental effect of improper illumination upon the health and happiness of the masses will hereafter be equally considered with the economical advantages of proper illumination to the person who initially pays for the installation and provides money for its operation. Any idea that the illuminating engineer of the future will be merely a gas-lighting or electric-lighting expert was dispelled by the very atmosphere of the convention.

Just what knowledge a person should possess in order to be classed as an illuminating engineer has not yet been formulated, but it can safely be stated that the lighting expert of the past must acquire much additional information before he can be ranked as an illuminating engineer in the future. Some idea of the requisite information can be gained from the lectures on illuminating engineering now being given at Johns Hopkins University. These lectures cover not only lamps and lighting, but the physical, physiological, psychological, architectural, decorative and commercial aspects of illumination. To the society and to the profession these thirty-six lectures, given by twenty-four lecturers, each a recognized master of the subjects which he presents, are of the highest importance. No more carefully selected list of lectures and lecturers was ever presented in a course of university instruction in an engineering subject, and probably no better list has ever been offered at any time in any single subject of any nature. That the lecture course is being duly appreciated is shown by the registration, which far exceeded the hoped-for 100 and reached the total of 250 on the opening day of the two weeks' course. The influence of the course will be widely felt, because those fortunate enough to attend will in many cases become the teachers of others, and

the lecture outline will set the example for courses in illuminating engineering to be given at other universities.

Without doubt the remarkable success with which this young society has met is largely due to the character of its organization, which precludes domination of any one locality in the government of the body. The result of this democratic system is that each section feels a direct responsibility in forwarding the objects of the society, and credit for achievements reflects on all alike. Equally important with the federal organization is the system of selection of officers by a board of nominators, consisting of past-presidents and past-vice-presidents, who, through experience, know best the work of the society and the qualifications desirable in those who are to carry it on. Moreover, since the vice-presidents on the board correspond in number and in residence to the several sections, at least two sections are represented in the choice of any nominee, thus rendering improbable any combination whereby one locality would secure undue advantages. The broad spirit which has characterized the career of the Illuminating Engineering Society and the keen interest taken in its work by the membership regardless of location appear, in short, to be ascribable to the truly national form of organization of that body, and to be sustained by a system of nomination which places at its head unquestioned leaders in the art and science represented, and in the other offices men selected intelligently with relation to their fitness for planning and carrying on the work of an active and progressive engineering body.

THE RAILWAY ELECTROLYSIS QUESTION.

Managers of electric-railway properties will breathe more freely, perhaps, now that Judge Sanborn, of the United States Circuit Court for the Northern District of Illinois, has handed down his decision in the famous "Peoria electrolysis case." This action has been in the courts for twelve years, while the controversy which caused it dates back to 1894. The complainant, the Peoria Water Works Company, asked an injunction against the Peoria Railway Company, alleging injury to its buried water pipes by electrolytic action caused by electricity escaping from the ground return of the electric railway of the defendant. In his decision the judge says that an injunction should be granted, but he declares that the railway company shall receive a reasonable time to "take such measures or put in such improvements to its negative return as will substantially prevent injury"; and the declaration for an injunction is made on the condition that the complainant co-operate with the defendant, so far as is reasonable and proper, in aiding the latter to prevent or lessen the escape of electricity from its rails, or in preventing the escape of electricity from the water pipes in such manner as to cause injury to the pipes. In effect, if a layman may venture to interpret the decision, the judge seems to say to the litigants: "Gentlemen, this is a serious matter, but the case is by no means desperate. It is altogether probable that means may be devised to prevent injury from the escape of electricity from the ground return of electric railways. It would seem to be a matter for co-operation and mutual helpfulness. Try to get together and solve this problem, in which you are both so deeply interested." And as a possible remedy the judge seems favorably impressed with the "quadrilateral" or constant-potential system of connecting the ground returns to prevent differences of potential and consequent escape of electricity. The whole opinion is characterized by moderation, in contrast with the views of the special master in chancery, who made it clear that he was convinced that the arguments of the water-works company should prevail.

The decision is an important one both to electric-railway companies and to the owners of buried metallic structures in city streets that may be affected by stray currents from the ground returns of the practically universal single-trolley type of railway construction. Complaints of damage due to electrolytic action have been frequent in American cities, and so the outcome of this long-drawn-out case was awaited with great interest. The master in chancery, in his reports, came out strongly in favor of the double-trolley system. According to the defendant's statement, cited in the judge's opinion, there are about 1600 single-trolley electric-railway systems in the United States and only one or two double-trolley equipments. The effect on the electric-railway industry if the master's conclusions were upheld may therefore be imagined. But the judge was not convinced that the situation needed this desperate and revolutionary remedy. He found that, on the whole, the damage done to water pipes in Peoria by electrolysis was lessening, and, moreover, that it is incorrect to assume that wherever a current of electricity leaves a buried pipe injury naturally follows, as electrolysis has a relation to surrounding conditions. The court intimated that the damage to the water-works system is not so serious as reported by the master, and seemed to believe, or at least to hope, that it may be rendered negligible by some plan of improving the rail-return system, perhaps by the adoption of the so-called "quadrilateral" or constant-potential system. Finally, the judge says that damage does exist and should be stopped, but reasonable time must be given to the defendant to effect improvements in its rail return to accomplish this, and the complainant must co-operate with the defendant in so doing. The exact terms of the arrangement to carry out the judge's decision are to be fixed when the final decree is applied for. Apparently the attorneys in the case wish ample time to digest the long and important decision of Judge Sanborn before applying for the decree—an act which in this case will be more than a mere formality.

RATES AND ACCOUNTING AT THE ILLINOIS CONVENTION.

The Illinois State Electric Association got together 149 central-station men at its convention at Rock Island last week, thus making a record in attendance. One of the most significant and gratifying features of the papers and discussions was the general attitude on the subject of rates and uniform accounting. For years past the discussions at state conventions on the subject of rates have shown that while a few managers appreciated the fundamental principles which should underlie any equitable system of rates, the great majority either failed to recognize or have failed to put in practice these principles, and have in actual use systems which not only hamper electric lighting in competition with other illuminants, but are often unjust to the consumer. At the recent Illinois convention it became evident that there is now a much better agreement than in the past among central-station men as to the principles which must be followed in formulating a system of rates. These principles were embodied in a report of the committee on rates, which advocated what it called the differential rate. This rate involves two factors, that of a fixed charge independent of output but dependent on demand, and a variable charge based on kw-hours output. In view of the fact that the Hopkinson or so-

called differential or multiple-rate or readiness-to-serve system has been recognized by state commissions and courts as equitable and just in principle, and is advocated by practically all students of the subject of rates, and in view of the further fact that bodies like the Illinois Association are now recommending such a system, it looks as if the time were not far distant when all companies not restricted by franchises or not absolutely blind to businesslike methods would adopt a rational rate system. Another gratifying feature of the convention was the announcement of the adoption by a number of companies of the standard system of accounting recommended by the National Electric Light Association, which system was by a vote urged by the association upon its members.

ALTERNATING-CURRENT MEASUREMENTS BY SUPERPOSING E.M.FS IN QUADRATURE.

When a telephone is used in a Wheatstone bridge in the place of the usual galvanometer, and the bridge is operated with alternating current, it is well known that there is great difficulty in making any adjustments that will bring about silence in the telephone. A large part of the difficulty is attributable to the fact that although the terminals of the telephone may be brought to the same effective value of alternating potential as might be determined by independent voltmeters, yet, because these potentials are not in the same phase, relatively strong currents may pass through the telephone. Another obstacle is that it is difficult to secure pure sine waves of alternating testing current, so that such current usually contains considerable traces of harmonic frequencies, each of which is a law unto itself. Finally, if the frequencies are of the telephonic order, small condenser capacities, such as that of an instrument and the observer's body, may give rise to appreciable disturbing currents. A simple form of laboratory testing apparatus for producing any desired phase displacement, as well as magnitude, of alternating e.m.f. is described by Prof. Absalon Larsen in a recent number of the *Elektrotechnische Zeitschrift*, as noted in the Digest. An alternating current, of as nearly constant frequency and pure sine form as possible, is passed through a slide-wire resistance and the primary winding of an air-core transformer in series. The secondary winding of this transformer will have an e.m.f. induced in it that must be in quadrature with the *IR* drop in the slide wire. Adjustable proportions of the secondary and *IR*-drop e.m.fs. may readily be compounded in series into a single resultant e.m.f. of any desired phase. The magnitude of the resultant can also be changed without changing the phase by changing the strength of the testing current. In this way any unknown e.m.f. can be annulled and measured by connecting a telephone in its circuit with the *IR*-drop and secondary voltage compensator. For weak currents generally, and for telephonic currents particularly, the above method of testing has many advantages and deserves to be remembered.

TEMPERATURE RISE DUE TO THE ENERGY RADIATED IN THE LOWER HEMISPHERE FROM DIFFERENT LIGHT SOURCES.

It is ordinarily assumed that when the zonal curve of luminous intensity for a given light source is correctly drawn, the same curve represents, to another scale, the distribution of total radiant intensity. That is, the assumption is usually made that if in any given direction the luminous intensity bears a certain ratio to the total radiation intensity, then this ratio will be maintained in all directions. This assumption has even been made the basis of photometric tests, as our columns have occasionally made known. Since the Ulbricht sphere supplies only a measurement of the mean spherical candle-power of a source, and obviously cannot give a measurement of the candle-power in the various directions required for a zonal distribution curve, it has been proposed to ascertain the zonal distribution, when required, by radiant energy measurements, thus eliminating the photometer. The plan has been to measure either bolometrically or with a thermopile the distribution of radiant power in a vertical plane through the light source, and to record the successive galvanometer deflections at successive angles, so that the graph of these deflections might be taken as the graph of luminous intensities, to some particular scale.

A paper read at the Baltimore convention of the Illuminating Engineering Society, by Messrs. J. G. Felton and E. J. Brady, demonstrates experimentally the danger of the above line of reasoning. If the color of the light in all directions is the same, and if there are no areas of non-uniform radiation giving out heat and light differently, the reasoning appears to be sound and the assumption justifiable. Cases may arise, however, in which great color differences or radiation differences occur. Thus, when an incandescent lamp was used, either alone or in a simple globe, the zonal curves of bolometrically observed total radiation intensity and of photometrically observed luminous intensity agreed very satisfactorily. But when a gas incandescent-mantle lamp was used with a green glass shade, there was a marked discrepancy between the two curves in the zones above and below the shade. Manifestly, the radiant heat would pass through the green glass shade with relatively little loss, but the luminous rays in the bundle would be largely absorbed. Again, a plain glass lamp chimney surrounding a gas burner in its upper portions gives off no light, but a very appreciable amount of heat, so that the zonal heat curve differs appreciably from the zonal light curve. Incidentally the paper illustrates the extent to which shades may cut down the total useful luminous output of a lamp.

ELECTRICITY AND YELLOW JOURNALISM.

The persistence with which the scare headline writer has followed the bad habits of earlier years in dealing with matters electrical is a constant source of wonder to us. One would suppose that after twenty years or so of peaceful development in the electrical field, the sensational press would have learned to take electric lighting and power as a matter of course. At the beginning there was the keenest kind of rivalry between gas and electric lighting, and indeed between electrical systems exploited by various interests, resulting in turning the searchlight upon every alleged accident or failure which gossip might suggest. Time was when it seemed to be the popular idea that the "deadly current" was in the habit of jumping across the street to set fire to buildings which had never been wired, and when a short-circuit and a dynamite explosion were placed in the same category. Even now it is curious to see the unanimity with which fires of absolutely unknown origin are charged up to electric circuits, when there are any in the vicinity, without considering the innumerable curious possibilities which have proved to be responsible for fire losses in the past.

If a fire is not plainly incendiary or known on direct evidence

to have been produced by some particular accident, the chances are that it will be credited to defective wiring if there is any current in the building, sometimes justifiably, more often on the merest surmise or in the absence of any proof to the contrary. It seems to be a case of assuming electric conductors to be guilty unless by chance they are proved to be innocent. Now, with all the care that is being taken at the present time and with the rigorous inspection of the underwriters, both in materials and actual construction, the inference ought to be rather against an electrical cause than for it. Fires may have curious origins never suspected by the ordinary man or indeed generally thought of by the expert unless after long investigation. For instance, the fact that an ordinary steam pipe may ignite dust even at its usual moderate temperature is a thing which, while known to the skilled investigators of the underwriters, would be considered quite impossible by the average householder. Spontaneous ignition of refuse, sometimes with almost explosive violence, may take place in quite unexpected fashion, or a dangerous fire among dry leaves has been produced by so seemingly impossible a cause as a spark struck by a scythe in use for mowing down the weeds. Yet it is a safe gamble that if a barn had been set on fire in the way just mentioned and there had been a transmission line across the field that line would have been charged with the crime.

In a similar way the old traditions of early and hard fighting days in the electrical art have persisted with respect to accidents to persons. Only the other day we saw heralded for perhaps the hundredth time a broken trolley wire sputtering in the street under the scare headline of "Death Menace to Hundreds." Now, in point of fact a sputtering trolley wire is about the least likely of all electrical conductors to menace the public with destruction, for the simple reason that everybody instinctively gives it a wide berth. The really dangerous thing is a supposedly dead wire. It is like the gun that isn't loaded. If a lineman is accidentally killed by a fall from a pole the chances are that accident will figure in some of the yellow journals under some such cheerful caption as "Roasted by 50,000 Volts," when he may have been working on a 110-volt circuit and missed his footing. Even when there really is a fatal accident from contact with the conductor it seems hardly necessary in these days to treat it with more sensational accompaniments than when an unfortunate carpenter falls off the roof of a house. There is certainly need for a change in the too common customs of some sensational dailies. Old habits are hard to break and we realize the traditions of the newspaper business, which came down from the time when direct current, alternating current and gas were engaged in a three-cornered fight for supremacy. That fight is now over, however, and there seems to be no reason for continuing the acerbity of treatment which was only too familiar twenty years ago. The times have changed and the manners of the headline writer ought to change with them.

ELECTRICAL WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT DURING 1909.

An abstract of the work of the national German laboratories at Charlottenburg, as accomplished and in course of conduct during 1909, has recently been published in the *Elektrotechnische Zeitschrift*. The Reichsanstalt carries on researches in many fields, so that the electrical work is only one portion, although an important portion, of the whole work conducted. In the department of standards the check measurements of manganin standard-ohm resistances have been continued. No change in these has been detected during the last sixteen years outside of the limits of instrumental and observational error. The chief difficulties in such measurements lie in measuring the temperatures of the standard resistances with the required degree of precision. According to definition, the standard ohm is the resistance of a column of mercury, in a glass tube, of definite cross-section and mass at the temperature of melting ice. Five such mercury standards have been in regular service. It has recently been found possible to make tubes of quartz, and two mercury standards in quartz tubes have been installed.

The silver coulometer is the adopted standard apparatus for determining the ampere. Much discussion has appeared in recent years over its international precision. Everyone admits that in a given laboratory one and the same observer or group of observers trained to a definite technical process in the use of the silver coulometer can repeat and reproduce their results with a high degree of precision, say, of the fifth order, or one part in 100,000. But it has been claimed that differently trained observers in different laboratories, not using identical technique, may be able to secure only a comparative agreement, of, say, the fourth order, so that as an international apparatus, in the absence of a rigidly universal technique, the precision of the coulometer has been criticised adversely. Some of the earlier determinations of the silver electrochemical equivalent had been made with the silver anode surrounded by a raw silk cover, while in others no such cover had been used. Recently instituted tests at Charlottenburg are stated to have shown no appreciable difference with these two conditions of measurement. In the second section of the Reichsanstalt a number of electrical researches are mentioned, such as measurements of feeble alternating currents, the production of constant frequency of alternation, and the measurement of the stray magnetic field of transformers. A research of especial practical interest to electric lighting engineers is that on the aging of fuses. It has been noticed that, after a certain duration of active service, a fuse may run hotter or even melt with normal current strength. Tests have indicated that a fuse wire steadily operated at a fairly high temperature may undergo a gradual increase of resistance, amounting in all to 20 per cent, accompanying a change in its substance. It seems to be suggested that such changes are not likely to occur at nearly normal temperatures.

It is pointed out in connection with optical measurements that the efforts which are being made by England, France and America to introduce a new unit of luminous intensity under the name of the "international candle" cannot be supported at present in Germany owing to objections against the definition of that unit. Consequently, protest must be entered upon the part of Germany against the name "international candle." Our German confrères do not seem to have taken the same standpoint regarding this matter as those countries entering into the candle agreement. No one disputes that a reliable, scientific, reproducible and practicable primary light source is a desirable thing. At present the best primary light source we have is the hefner, and it is far from meeting all our needs. Meanwhile, England, France and America tried to maintain their respective national candles on a primary flame basis, each for its own. Flame standards are subject to such irregularities

that no satisfactory permanence or reproducibility yet exists for them. Properly seasoned incandescent lamps, however, possess the property of maintaining and reproducing an arbitrarily chosen standard of luminous intensity with a satisfactory degree of precision. The three countries, therefore, agreed virtually to sink their primary flame standards to a subordinate position and to maintain a certain mean or compromise luminous intensity as representing the candle, with the aid of mutually interchanged incandescent lamps. In a few years we may expect that a "candle" will have no other meaning than this co-operatively maintained standard of luminous intensity, which incidentally is decimally related to the hefner, because the hefner is nine-tenths of this candle. Germany's protest against the term "international" candle must, of course, be respected. No standard can be international in the same sense as the volt, ohm or ampere until it is adopted by all civilized countries. Nevertheless, the three contracting countries have by their action aided German photometry as well as their own, because they have swept out of competition confusing and supernumerary standards. There remain only the compromise candle and the hefner, instead of three different candles and the hefner.

TEMPERATURE-COEFFICIENT OF RESISTANCE OF COPPER.

There is hardly any thermal constant of a metal more important to the electrical engineer than the temperature-coefficient of resistivity in copper. Upon the magnitude of this constant depends the change in resistance that a copper wire will offer when subjected to change of temperature, the change in joulean power that a given current will develop in that resistance as I^2R watts, and, reciprocally, the change of temperature which a certain thermal change of resistance betokens. If different engineers employ different temperature-coefficients, they will differ correspondingly in their determinations of temperature-elevation of dynamo field-coils and similar apparatus, as computed from thermal increase in resistance. It is, therefore, important to know with precision how great this coefficient is, and how it varies in different samples of copper. It is also important that all engineers should come to an international agreement upon the value to be adopted. At the present time there is a very appreciable range of variation in the values that are used in different countries. There are two fundamental electrical constants for a metallic conducting substance, namely (1) the resistivity, or specific resistance, at a standard temperature, and (2) the temperature-coefficient of that resistivity. Resistivity is expressed either in ohms to the cubic centimeter (ohm-cm) or in ohms to the meter-gram. In the former we refer to the resistance offered by 1 cu. cm of the substance at the standard temperature, between any pair of opposed faces. In the latter we refer to the resistance offered by a uniform wire or prism of the substance at the standard temperature, 1 meter long and weighing just 1 gram. The two expressions are definitely connected through the specific gravity of the substance. In practice, however, measurements are easier and more precisely made with reference to the meter-gram than to the centimeter cube.

The resistivity of copper is now generally admitted to follow a straight-line law between the temperatures of 0 deg. C. and 100 deg. C., the most important range to the electrical engineer. Beyond these limits the shape of the resistance-temperature curve is in some doubt. But for all practical purposes relating to this useful range of temperature we may safely make the arbitrary assumption that the straight line continues steadily as the temperature is lowered. This means that there is a certain definite low temperature at which the resistivity of copper would be nil, which inferred temperature may be called the inferred absolute zero of copper-resistivity. This corresponds by analogy to the inferred absolute zero of volume for gases. Thus, at 0 deg. C. the temperature-coefficient of expansion of gases is usually taken as 0.00366. Hence the inferred absolute zero of volume of gas, assuming the continuance downward of this straight-line law, is $-1/0.00366 = -273$ deg. C. Similarly, if copper be taken to have a straight-line resistivity coefficient of 0.004 at, say, 15 deg. C., then the inferred absolute zero of resistivity is $-1/0.004 = -250 + 15 = -235$ deg. C., or the copper-resistivity behaves between 0 deg. C. and 100 deg. C. as though it started from zero at —235 deg. C. Thus premised, all resistivities are proportional to the absolute temperature of the substance, counting 100 deg. C. as 335 deg. abs., 30 deg. C. as 265 deg. abs., and so on. Consequently, copper is completely defined electrically when we give its meter-gram resistance at a standard temperature and its inferred absolute temperature of zero resistivity.

The *Journal* of the Franklin Institute has recently published an interesting abstract, by Mr. J. H. Dellinger, of a paper shortly to appear in the *Bulletin* of the Bureau of Standards. A large number of samples of good commercial copper from different manufacturers were tested at the bureau both for resistivity and for the temperature-coefficient of the same. The remarkable deduction is drawn from these measurements that between the limits of variation presented in practice for resistivity the temperature-coefficient varies inversely as the resistivity i.e., directly as the conductivity. Thus, the bureau has selected a meter-gram of soft copper at 20 deg. C. as having 0.153022 international ohm. This may be called a definition of 100 per cent conductivity on an arbitrary scale corresponding to "Matthiessen's standard." This quality of copper has a temperature-coefficient of 0.00394 at 20 deg. C., or an absolute temperature of $-1/0.00394 = -253.8 + 20 = -233.8$ deg. C. The temperature-coefficient at 0 deg. C. is thus $1/233.8 = 0.004277$. If now some other sample of wire, hard drawn or otherwise slightly imperfect, has 2 per cent greater resistivity than this standard, its absolute temperature below zero will be 2 per cent greater than — 233.8, or — 238.5. Or, if the conductivity of the new sample is 2 per cent less than the normal, the temperature-coefficient will be 2 per cent less than 0.00394 at 20 deg. C.

The outcome of the research at the Bureau of Standards is, therefore, that between the conductivity range of 97 and 102 per cent there is only one essential electrical definition of copper—either the resistivity or its temperature-coefficient; because if one of these is known the other may be deduced immediately. The temperature-coefficient adopted by the American Institute of Electrical Engineers is 0.0042 from and at 0 deg. C., corresponding to an inferred absolute resistivity zero temperature of —238.1 deg. C. That adopted by the Institution of Electrical Engineers in England is 0.00428, or —233.6 deg. C. The value taken by the Verband Deutscher Elektrotechniker is 0.00426 or — 234.7 deg. C., and that generally used in France is 0.004, or — 250 deg. C. Excepting the last named, it would appear that the values obtained lie close together, and that there should be little difficulty in reaching an international agreement. It is to be hoped that this matter may be brought to the attention of the International Electrotechnical Commission for an early discussion.

Illuminating Engineering Lecture and Laboratory Course.

If attendance and enthusiasm can be taken as criteria of success, then the course of lectures and laboratory demonstrations relating to illuminating engineering being given by the Johns Hopkins University in co-operation with the Illuminating Engineering Society is successful far beyond expectations. When the plan was first formulated an attendance of 100 was hoped for. The advance registration reached 150, while more than 200 had registered before the opening exercises. Before the lectures began the registration totaled 230, which was the maximum number that could be accommodated without altering the arrangements. Additional facilities were provided so as to accommodate the 250 who finally applied for admission to the course.

The exercises connected with the inauguration of the lecture course were held on the afternoon of Tuesday, Oct. 25, in McCoy Hall at the university. Dr. Ira Remsen, president of the university, in the opening address, expressed his gratification that Johns Hopkins had been selected for the highly important work of providing the most noteworthy series of lectures ever offered to students in the beginning of a course of study of an engineering nature.

Dr. E. P. Hyde, as president of the Illuminating Engineering Society, outlined the three objects of the lecture course, namely, to indicate the proper co-ordination of those arts and sciences which constitute illuminating engineering; to furnish a condensed outline of study suitable for elaboration into an undergraduate course for introduction into the curricula of undergraduate technical schools, and to give practising engineers an opportunity to obtain a conception of the science of illuminating engineering as a whole. He called particular attention to the high standing of the lecturers, who were invited by the university upon the advice of the society.

Mr. Herbert A. Wagner, on behalf of the president of the Association of Edison Illuminating Companies, stated that the interest of the association in the work of the society is vital, and remarked that only within the past few years has the importance of illuminating engineering been appreciated.

Mr. W. W. Freeman, president of the National Electric Light Association, said that the inauguration of the lecture course was an event of much interest to all, and the work of the society has proved to be of great value to the lighting industry.

Mr. W. C. Morris, vice-president of the American Gas Institute, claimed that the need for instruction in illuminating engineering had become urgent, because the public must be educated in the proper use of lamps and lighting fixtures.

Dr. J. B. Whitehead, acting for the president of the American Institute of Electrical Engineers, commented upon the close relation between the advancement in the knowledge of illumination and the improvement in the efficiency of electric lamps. He congratulated both the society and the university upon the lecture course on illuminating engineering.

Dr. Samuel Theobald, president of the American Ophthalmological Society, expressed his great interest in the work of the Illuminating Engineering Society, especially along the lines of protection to the eyes by the use of proper shades and reflectors to eliminate or reduce glare. He claimed that no light from the lamp should be allowed to reach the eye directly, but all light should be directed toward the objects to be viewed.

Dr. Wendell Reber, president of the Academy of Ophthalmology and Oto-Laryngology, stated that the eyes should always be protected from the harmful invisible rays, for which purpose yellow-green glass is quite satisfastory. It will be to the advantage of all for those interested in the eyes to cooperate with those interested in light, and steps should be taken by the proper societies to ensure such co-operation.

Mr. J. R. Sloan, president of the Association of Railway Electrical Engineers, said that much valuable assistance has been rendered by the Illuminating Engineering Society in formulating the laws of illumination so that they may be applied in the practical problems that arise. The effects are to be noted in railway-car lighting, where the improvements seen are attributable not only to the use of better lamps, but to the employment of better illuminating arrangements.

In addition to the connecting link between the convention of the Illuminating Engineering Society and the lecture course at Johns Hopkins University formed by the above-mentioned opening exercises, a noteworthy event was the banquet held at the Hotel Belvedere on Tuesday evening, which was much enjoyed by those present. Almost all of those in attendance being college graduates, the college spirit was let loose and good-fellowship became the keynote of the evening. Gen. George H. Harries acted as toastmaster. Toasts were responded to by Mayor Mahool, Dr. Remsen, Dr. Hyde and Hon. Ferdinand C. Latrobe.

Montreal Lighting Controversy.

The Montreal Light, Heat & Power Company and the City of Montreal finally settled their differences with regard to the charges for a lighting service furnished the city during the preceding twenty-two months by the company's accepting the price of $72.70 per year per arc lamp, the city assuming in addition all the costs of the case. The amount paid over by the city aggregates something over $240,000 for lighting service in addition to the cost. The price of $72.70 agreed upon in settlement is the same figure as tendered by the Montreal Light, Heat & Power Company and accepted by the city in the award of a ten years' lighting contract made a few weeks ago. The price for which the company had brought suit was about $90 per lamp per year.

It will be recalled that the merits of the value of the service rendered by the company in lighting the city were being determined by a board of arbitrators consisting of Prof. L. A. Herdt, Mr. R. G. Black and Mr. A. A. Dion. Although hearings had continued throughout the summer, the cross-examination of only the second witness called by the plaintiff, its superintendent, Mr. R. M. Wilson, had not yet been completed and the company's other experts, Mr. Henry Floy, of New York, and Mr. R. S. Kelsch, of Montreal, had not yet been called. From the progress made it became evident to both sides of the controversy that the hearings would be indefinitely prolonged and the expense amount to more than either the company or the city could hope to gain by a decision through the board of arbitration.

With this situation in mind, the city authorities concluded it wise to agree to pay somewhat more than had been thought a fair price by them, and at the same time the company yielded somewhat in the price claimed by it as the value of the service in order to meet the city and wipe out the unpleasant relations that have existed for the last two or three years between the city and the company.

New York Electrical Society Meeting.

An entertaining and instructive lecture on motion pictures in natural colors was delivered before the New York Electrical Society on Oct. 28 by Mr. Gilbert H. Aymar. The speaker described and demonstrated the process of Urban and Smith, according to which the views are shown alternately by red and green light. The views, which resemble the ordinary photographic black and white, possess just the requisite amount of red and green so that when combined by the "persistence of vision" they appear in the colors supplied by nature. A remarkable feature was the fact that even the blue and violet colors were properly represented on the screen, and all colors seemed true to nature. Only in the case of rapid motion was a defect noticeable, when the "green" view of a moving object failed to be superposed in space upon the corresponding "red" view of the same object, the result being distinct separate red and green views of the same object in progression across the screen. The views are shown at the rate of thirty-two impressions per second, which is just double the rate used with the ordi-

nary motion picture. Use is made of an electric motor for driving the film and synchronized red-and-green screen mechanisms, while an arc lamp with carbon electrodes is used for supplying the light, which is filtered through color screens to obtain the proper alternate red and green rays.

The Metric System and Export Trade with European Continental Countries.

Dr. Gino Dompieri, of Trieste, president of the South Austrian Engineers' Society, in a communication to this journal points out the handicap to the extension of American trade on the Continent of Europe due to the English system of weights and measures. This applies particularly to the case of exports like machinery, metal goods, material used in the construction of buildings, bridges, etc. When plans for an engineering work are undertaken, and designs and specifications are being prepared, the American system of weights and measures is found annoying to deal with, as the equivalents in metric figures have either to be calculated or reference made to tables of equivalents. Furthermore, an engineer using Continental material is able to select his material readily by recourse to a French or German "Ready Reckoner," which gives formulas, tables, etc., corresponding with commercial standards of weights, dimensions, etc. All of these tables, however, refer to the metric system, as at present screws are the only article manufactured on the Continent of Europe that does not conform to this system. A new metric screw standard has, however, been recently adopted by the Association of German Engineers, which will supplant the Whitworth screw standard as the old screw-cutting machines wear out. In the case of American publications, trade circulars, etc., the metric equivalents of engineering material are very rarely given, and an engineer thus does not know, without laborious calculation, the equivalent of the English dimensions in the metric system.

Dr. Dompieri refers to the German publication "Hutte" as a thorough vade mecum of general engineering, which is translated into the principal European languages and a new edition issued biennially. This book, which contains formulas, tables, etc., in every branch of engineering, is edited by a committee of engineers, and is accepted as an engineering rather than as a commercial publication. The Continental engineer, who goes much more into detail than the American engineer, will, for instance, in designing a bridge or other similar structure refer to this book in the selection of girders, etc., as in it he will find all of the data, including dimensions, weights, moments of inertia, etc. If he had in mind obtaining proposals for American girders, angles, etc., he would be embarrassed to ascertain whether the calculated size could be procured; as, however, he does know that all of the sizes given in the "Hutte" are made by Continental iron workers, he will be apt to consider only Continental contractors. The same is true in the case of manufacturers of machinery, whose technical staffs use exclusively the "Hutte" or a similar handbook. The "Hutte" even goes so far as to insert, in the case of special material, the name of the German firm from which it may be secured. Handbooks of this kind are inclining Continental engineers and purchasers more and more to the exclusive use of material listed therein. Dr. Dompieri states that he has designed many plants for installation in the principal industrial centers of Europe and also directed the installation of many works, and has come to the conclusion that very frequently American materials are not specified owing to the fact that they are not represented in engineers' handbooks of the above-mentioned kind, and he has also found that Continental architects and engineers practically ignore the use of American material for that reason.

In conclusion Dr. Dompieri says that if American industrial firms wish to secure a footing in the Continental market they must make their products known there through engineers' handbooks and in quoting the goods must use the metric system. He suggests that American manufacturers might co-operate and compile a handbook of general engineering similar to the "Hutte," not printing it, however, as a trade publication, but placing the matter with a regular publisher of engineering books. Such a book, while on the same general lines as the "Hutte," could with benefit be made more extensive with regard to mechanics, electrotechnics, machine tools, etc. Besides an edition in English the book should be translated into French and published simultaneously in both countries. The book should be sold at cost, the aim being solely to facilitate the sale of American goods on the Continent of Europe and in countries elsewhere using the metric system.

Electrical Protective League of Chicago.

The Electrical Protective League of Chicago was incorporated under the laws of Illinois on Oct. 8. It consists of about forty-five manufacturers, jobbers and dealers in electrical appliances in Chicago. In a number of cases electrical dealers have suffered loss by allowing goods to be taken away on "fake" orders, received, perhaps, over the telephone. Orders have come in, apparently placed in good faith and in the regular way, by some reputable concern, and later a wagon would appear to secure the goods, which would be turned over to the teamster without suspicion. When the bill was presented to the supposed customer, however, it would transpire that the latter was totally ignorant of the transaction, the dealer simply being the victim of a confidence game. This practice, or dishonest methods akin to it, has become too frequent, and the new Electrical Protective League has been incorporated for the mutual protection of its members against the loss of goods by dishonest practices. One of the best lawyers in Chicago has been retained as the counsel for the league, and in the future all cases of this kind in which any member of the new organization is the sufferer will be prosecuted to the limit by the organization and not by the individual who has suffered loss. The officers of the league are: President, Louis A. Schwab, Monarch Electric & Wire Company; treasurer, N. G. Harvey, Illinois Electric Company; directors, Mr. Schwab, Mr. Harvey and F. M. Pierce, of the Manhattan Electrical Supply Company; F. Overbagh, of Overbagh & Ayres Manufacturing Company, and James Wolff, of the New York Insulated Wire Company. The office of the league will be at 411 South Clinton Street.

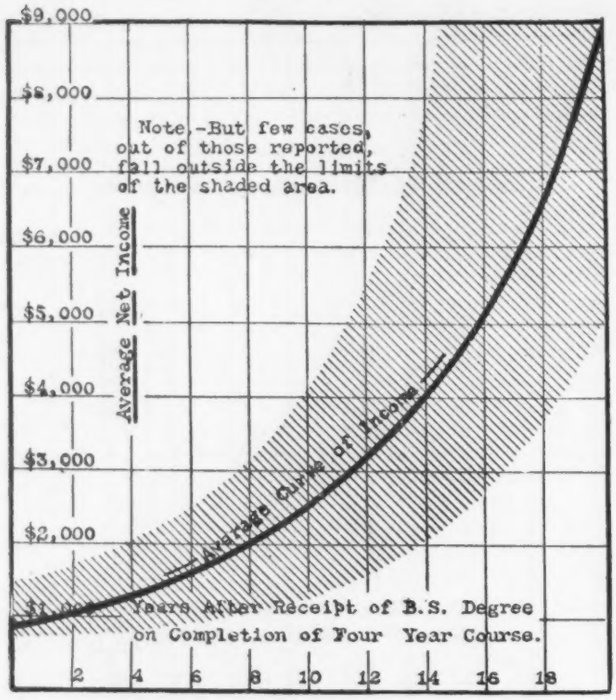
Electrical Developments in China.

Contracts were let last year for electric light plants at Chungking, Chengtu, Changsha, Nanking and Ningpo, China, and for more or less important extensions at Shanghai (settlements and native city), Hankow, Peking, Swatow, Mukden and other places. Negotiations were proceeding at the beginning of 1910 for a large installation at Hanchow and for installations in several cities in Manchuria. There is said to be an electric lighting project in every city in China, although at Pakhoi the project is stated to have been abandoned in view of the successful introduction of incandescent gas mantles; the only difficulty is to find funds for carrying such projects into execution. An electric tramway scheme for Canton is under contemplation, a considerable extension of the telephone system in that city has recently been carried out, and preparations are being made for inaugurating telephone services at Chengtu, at Wuhu and in the provinces of Giangsi and Chekiang.

A British commercial attaché states that the conditions with respect to selling to such plants are such that British manufacturers are at a great disadvantage in competition. Almost all contracts require to be financed by the contractors, and British firms, finding British manufacturers unwilling to supply plant except for cash down, have sometimes co-operated with German firms, the latter arranging the finances in return for being allowed to participate. Thus several recent contracts are for British engines and boilers and German dynamos. Payment is generally spread over a period of two or three years on proper security being given.

Average Income of Technical Graduates.

The Worcester Polytechnic Institute has published in diagrammatic form the results of a canvass made by Prof. H. B. Smith of the electrical engineering alumni of the institute in order to determine the present average annual income. A reproduction of the diagram is given herewith, which, it will be seen, indicates a material prosperity of the graduates that probably prevails in few, if any, other professions.



Conservation Without Development.

At the recent meeting of the Kansas Gas, Water, Electric Light and Street Railway Association Mr. Edwin R. Weeks, past-president of the National Electric Light Association, presented a paper which included a review of the James River Dam case, with which Mr. Weeks was professionally connected. The petitioners for legislative action for hydraulic development on the James River owned all the land on both sides of the river; that is to say, the full title was vested in them, and neither the State nor the United States nor any private person could either develop or acquire these rights without their consent or without giving an adequate consideration. It was necessary, however, for the owners, the petitioners in the case, to borrow funds with which to construct the plant, and the bankers to whom they applied said they would furnish the money if Congress would pass a resolution declaring the river unnavigable, which it was well known to be, as fully established by surveys. It was also shown by the surveys that, with a moderate investment, power could be distributed to a wide area at about one-half its present cost.

After the resolution had been introduced into Congress and had passed the House, President Roosevelt called a conference of the Governors of the several States to consider the question of conservation. Mr. Weeks advised his clients, the principals in the James River enterprise, to withdraw the resolution and let the whole matter rest until a more propitious time. It was decided, however, that the particular case could be easily differentiated from others wherein the State owned all the riparian rights, and the measure was put up to President Roosevelt. The result is that the water-power is still being "conserved," the people interested are bearing the burden of heavy expenses incurred, and the water is still wearing away the rocks.

In conclusion Mr. Weeks said that this question has been handled not only unjustly, but with far too little practical economic sense. While he believes in the doctrine of conservation of natural resources and considers that their waste has long been a national sin, he nevertheless thinks that there is no proper conservation without development in cases where there is an economic necessity for such development. In such cases if the State withholds from private interests the necessary grant it becomes the duty of the State to make the development. The best conservation of any resource, he added, is its economic use.

The Patents of Thomas Alva Edison.

By Joseph J. O'Brien.

While a great deal has been written about Edison and his inventions, there seems to be general confusion as to the scope of his activity and the fields in which he has worked. In the June number of the *Cosmopolitan Magazine* the statement is made that Edison is credited with over 500 patents, and the "Encyclopedia Americana" makes a similar error in its article on Edison. With the view of correcting existing errors and of establishing a better conception of the importance of Edison's work, and of defining some of its limits, the following review is offered. First, however, it seems desirable that some figures of the total number of patents issued by the United States Patent Office and the number issued in important classes, including the electrical classes, should be given.

From 1790, when the patent system was founded, to July 4, 1836, before the reorganization of the system, a total of 10,048 patents were issued. Most of the records of these patents were destroyed in a fire and but 2236 records were restored. Since the reorganization, which followed a Congressional investigation and which resulted in the establishment of the examination system, a total of 956,506 patents have been issued. The total of all patents issued before 1836 and after is 966,554, up to and including the issue of April 26, 1910.

The total number of electrical patents issued up to May 13, 1910, is about 58,057, or approximately one-sixteenth of all United States patents. The accompanying table gives the distribution of the patents by classes and sub-classes, excepting a number estimated at 5000, which are not distinctively classified:

TABLE I.—ELECTRICAL PATENTS IN CLASSES AND SUB-CLASSES

Class	No. of Class	Patents	Total
Electricity, Generation	171	6,626	
" Motive Power	172	4,241	
" Conductors	173	2,956	
" Medical and Surgical	174	823	
" General Appliances	175	4,473	
Electric Lighting	176	5,422	
Electric Signaling	177	2,078	
Telegraphy	178	5,468	
Telephony	179	4,490	
Electrochemistry	204	5,389	
Electric Heaters	219	1,774	
Conduits	247	1,824	45,564
Eighteen sub-classes, in classes 123, 188, 105, 104, 73, 58, 234, 161, 246, 236, 89, 83, 197, 189, 84, 46, 21, 235		7,493	
Estimate of other electrical patents in other classes		5,000	58,057

Edison secured his first patent on June 1, 1869, on an electrographic vote recorder for use in Congress to secure quick vote counting, its number being 90,646. Mr. Carroll D. Wright, who later became Commissioner of Labor, and who wrote the excellent book "Industrial Evolution," was Edison's first attorney. Since June 1, 1869, Edison has had issued to him a total of 905 patents. These patents may be classified under seventeen heads, as shown in Table II.

About 190 of Edison's patents may be considered as mechanical or may be excluded from the list of patents which are electrical in nature or in application, leaving a total of 713 patents which may be regarded as electrical. This total is about 1/63 of the number of patents in the electrical classes, or about 1/81 of the number in these classes and in the subclasses.

The proportion of Edison's patents in the art of electrical communication, which includes telegraphy, telephony and signaling, is 1/78, there being 184 patents to his credit in this art out of a total of 14,504 patents issued in the art. The proportion of Edison's patents in the art of electrical illumination is 1/28, there being 190 patents to Edison's credit in this art and 5422 patents issued in the art. There are 939 patents issued on phonographs, and of these 109 belong to Edison, thus representing 1/9 of the total number in the art. There are 1292 patents issued on secondary batteries, classed under Electrochemistry, No. 204. Edison has seventy-eight patents in this art, which is 1/17 of the total number.

TABLE II.—CLASSIFICATION OF U. S. PATENTS ISSUED TO EDISON.

	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	Totals.
1. Electrical communication	3	..	6	33	20	12	19	8	7	14	5	2	2	4	5	..	5	8	1	3	1	12	4	8	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	184
2. Electrical illumination	..	..	..	..	..	..	..	..	..	..	..	5	7	44	24	17	10	6	7	4	5	11	16	8	12	3	2	6	..	..	..	1	..	..	..	..	..	1	..	..	1	..	..	190
3. Electrical power machinery	..	1	1	..	..	..	..	..	..	..	..	3	1	9	38	24	9	1	..	2	4	1	7	3	5	1	1	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	113
4. Electrical batteries	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	3	8	5	5	3	14	15	10	7	5	81
5. Distribution of electricity	..	..	..	..	..	..	..	..	..	..	..	..	5	5	11	1	..	2	13	5	1	5	1	5	2	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59
6. Measurement of electricity	..	..	..	..	..	..	..	..	..	..	..	..	6	1	1	4	..	..	1	..	2	1	..	2	..	..	..	..	..	..	..	3	..	1	..	..	..	..	..	..	..	..	22
7. Electrical traction	..	..	..	..	..	..	..	..	..	..	..	..	..	2	3	1	..	1	..	..	..	2	2	11	2	..	..	..	..	..	..	..	..	..	1	2	..	..	..	..	..	1	28
8. Electro-chemistry	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	2	1	..	..	2	1	..	..	10
9. Ore, cement and milling	..	..	..	..	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..	1	2	3	2	10	2	1	..	2	..	3	1	5	13	2	1	8	1	3	4	1	9	..	77
10. Phonographs	..	..	..	..	..	..	..	..	..	3	..	1	..	..	..	..	..	..	17	19	14	11	7	5	2	2	..	1	4	1	3	5	4	..	..	2	2	1	..	4	1	109
11. Photography	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	1	..	..	1	..	..	..	1	..	..	..	..	..	..	..	4
12. Office appliances	..	..	..	1	..	..	..	1	1	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	9
13. Journal bearings and gearing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	4	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	1	1	10
14. Compressed air	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	1	..	..	..	..	..	..	..	..	..	3
15. Wire drawing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
16. Glass	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
17. Fruit preserving	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Totals	3	1	7	34	20	12	19	9	8	19	13	14	69	75	65	26	12	18	21	35	37	65	32	65	20	9	10	3	2	8	3	15	23	15	10	17	7	19	23	12	22	8	905
Patents assigned before issue	2	1	5	15	15	8	16	8	7	11	2	1	42	36	25	8	4	6	5	11	10	15	10	17	5	3	3	..	..	..	..	1	..	8	2	6	..	14	15	11	14	4	355
Joint patents	..	2	..	..	..	..	..	1	..	..	..	..	2	..	..	..	..	4	..	1	..	3	..	3	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	17
Reissue patents	..	2	..	..	2	..	..	..	1	..	1	..	..	..	..	1	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	2	..	1	1	..	..	..	..	..	13

By examining Table II it will be noted that Edison's work has moved in waves. His work in telegraphy began with his career as an operator, or rather preceded this, beginning with his association with operators. From 1869 to 1894, with the exception of two years, 1870 and 1884, one or more patents were issued to Edison in the art, or rather arts, of electrical communication. From telegraphy he went into the telephonic field. After 1894 but one patent was issued to him in any of the arts of electrical communication.

TABLE III.—EDISON U. S. PATENT ISSUES BY YEARS.

1869..... 3	1880.....14	1891.....32	1902..... 15
1870..... 1	1881.....69	1892.....65	1903..... 10
1871..... 7	1882.....75	1893.....20	1904..... 17
1872.....34	1883.....65	1894..... 9	1905..... 7
1873.....20	1884.....26	1895.....10	1906..... 19
1874.....12	1885.....12	1896..... 3	1907..... 23
1875.....19	1886.....18	1897..... 2	1908..... 12
1876..... 9	1887.....21	1898..... 8	1909..... 22
1877..... 8	1888.....35	1899..... 3	1910..... 8
1878.....19	1889.....37	1900.....15	
1879.....13	1890.....65	1901.....23	41 years.....905

From Table II it is seen that Edison has had a ready market at practically all times for his patents, and that a considerable number of his patents were assigned before issue. This factor is an important one in considering the elements of Edison's success. In practically all of that portion of his work which has been placed under patent protection Edison has, without reasonable doubt, followed the demands of the market. That part of his work which anticipated the market has been withheld, and that part which possessed purely scientific value was denied to the world. What Edison might have done in the fields of discovery had he been free to carry out such plans as have formed in his mind, along the lines of original scientific work is very hard to estimate.

In 1879 Edison secured five patents in the art of electrical illumination and these patents really marked the beginning of his more important inventive successes, such as led up to the organization of the numerous Edison companies all over the United States. Telegraphic work led to the vote recorder, to the stencil pen, which in turn opened the field of office appliances, and which led directly to the speaking telegraph, as the telephone was first called. From the diaphragm of the telephone came the phonograph. Without the knowledge and insight which extensive work with electromagnets gave the magnetic ore separator would not have been created. After the carbon filament was produced a demand was felt for improved generators, distributing systems, meters, regulators and manufacturing processes in order that an economic system of electric lighting could be produced.

From the records of the Patent Office we are able to compute the number of patents issued to Edison, but these records are silent as to the number of applications pending, the number of applications filed and not brought to issue and the number of inventions now being prepared for patent. It is reasonable to conclude that Edison abandoned many inventions in the art of communication after his unhappy experience with the telegraph companies. It is also reasonable to conclude that he never brought to the application stage many inventions to which he could not devote time or expense to project, and that this number is very large.

The process of shaping an invention for the Patent Office and then for the market is a long and tedious one, and the limits of one's energies and resources would naturally restrict the number of inventions that can be projected into the market. In every large orchard there is a large quantity of fruit that is never brought to the market. The process of pruning is used by inventors as well as by farmers. There is a difference, however, as inventors are often compelled to prune, or suppress and withhold, inventions of the greatest value in order that they may not be swamped economically in their promotion.

A liberal estimate of all Edison's inventions would bring the grand total up to near 2000. This conclusion is based on the assumption that the number of unissued cases in the Patent Office is considerably over 200; that he has at least 100 inventions in the preliminary stage, and that he has produced a large number of inventions which could not be developed by experiments or projected by patents and manufacture, equal to, or nearly equal to, the number actually patented.

Grounding in Mines.

The Bureau of Standards in its recent circular (No. 23) on the subject of standardization of electrical practice in mines, which received notice in our issue of last week, discusses grounding in mines in a note explanatory of a rule requiring the grounding of circuits, machine frames, etc.

Referring to the rule requiring that the frames and bedplates of generators, motors and transformers and the metallic coverings of cables, switches, etc., shall be grounded, it is stated that four objections are usually brought against grounding as thus required, as follows:

(1) It produces greater strain on the insulation. (2) A single fault in the insulation requires the shutting down of the machine or cable. (3) Such a fault may develop a short-circuit and the flash which results may ignite gas, should the latter be present. (4) Difficulty is often experienced in making a good ground, especially for coal-cutter motors.

The first of these objections can, it is stated, be justified only on the ground of economy in the initial installation. It is true that a somewhat cheaper machine can be built where the insulation strains can be kept low, but in the case of low-voltage or medium-voltage machines for mining work the severe mechanical strains that are put on the insulation due to severe overloads, mechanical shocks, etc., require that the insulation be of such strength and quality that the additional voltage strain that would be caused by grounding the frame would be of relatively small consequence. The difference in cost would, therefore, be of such slight importance that it would be hardly worthy of consideration in comparison with the much more important question of safety.

As regards the second objection, that a single fault in the insulation makes it necessary to shut down the machine, it must be said that this is true only in case one point of the electric circuit is grounded, and even then it can hardly be regarded as a disadvantage. A machine which has developed a fault in its insulation should never be continued in operation in a mine even though such operation may be possible. Any machine that has developed a fault in its insulation is obviously more likely to develop another than one in which trouble has never occurred, because the appearance of the first fault often indicates a bad condition of the insulation as a whole. Hence it is more dangerous to operate a machine that is grounded through defective insulation than to operate one in which the frame is intentionally connected to earth. Moreover, either through overlooking the defect, or owing to the inevitable tendency of the operator to keep the machine in operation, even after the first defect is discovered, this condition of greater danger would frequently arise.

The third objection mentioned carries practically no weight for the reason that the rules prohibit the operation of electric machines where gas in explosive quantities is present, and the possibility of a short-circuit developing during the interval between the appearance of gas and the shutting down of the machine is very remote.

The last objection is not serious since the ground wire need not be of large current-carrying capacity, hence a small flexible wire can be run to any convenient ground plate or other suitable ground, either back along the trailing cable or separately as the case may require. Since this wire is not alive its presence cannot be regarded as materially objectionable and the question of insulation does not arise at all.

On the other hand, we have the unquestionable fact, supported by numerous authentic records, that persons have frequently been killed by coming in contact with the ungrounded frame of a motor or coal cutter which had accidentally become alive even from a lower-stage circuit; whereas such accidents are rendered absolutely impossible by the thorough grounding of the frames of such machines.

It would seem, therefore, that the doubtful advantage of ungrounded machine frames can hardly be regarded as comparable with the positive safety from shock assured by the thorough grounding of such machines.

Grounding of machine frames, cable sheaths, etc., is required by law in Great Britain, the Cape of Good Hope and New South Wales.

Taking up another section of the same rule, the note says that the grounding of three-wire direct-current systems and all alternating-current systems of low voltage or medium voltage is deemed of great importance as a measure of safety. The large number of deaths from electric shock from low-voltage and medium-voltage circuits has proven beyond a doubt that the danger even from low-voltage circuits is serious and should be guarded against wherever possible. Three-wire systems are rarely installed in mines for lower than medium voltages, and since the grounding of the neutral of such a system reduces the normal working pressure between either line and ground to one-half what it would if one side were grounded it is desirable that the neutral point be grounded wherever possible.

In alternating-current systems the danger from shock arises from two sources, viz., from the normal working pressure of the circuit and in the case of secondary circuits from the high pressure of the primary circuit due to accidental contact between primary and secondary system. Danger from the latter source is eliminated by grounding any point of the secondary system. If one side of the secondary be grounded, however, there would still remain the danger of shock from the normal working pressure of the secondary circuit, while if the neutral or middle point of the secondary winding of the transformer be grounded a person standing on the ground and touching either wire would receive only half of the normal working pressure between lines in the case of a single-phase system. Here, again, therefore, the neutral should be grounded wherever possible. Most of the companies are now prepared to supply standard types of transformers in which the neutral can readily be grounded when working at pressures of 220 volts or 440 volts, so that this presents no difficulty. In three-phase systems two cases have to be considered, viz., the delta and the star-connected secondaries. In the latter the common connection of the three phases is commonly called the neutral, and this point should always be grounded, since by so doing the voltage between any line and ground is reduced to about 58 per cent of what it would be if one line were grounded. In case the secondary is connected in delta there is no neutral point as in the case of the star connection. In this case the neutral point of one phase, and one only, should always be grounded, as in this case the pressure between two of the lines and the ground is reduced to one-half of the normal working pressure between lines, and that between the third line and ground is reduced to about 86 per cent of the normal line voltage. It is apparent, therefore, that grounding a proper neutral point on any system greatly reduces the danger of shock. It may be noted that the delta-connected system gives a somewhat less satisfactory condition in this respect, but inasmuch as this connection is sometimes preferable in practical operation it does not seem desirable to prohibit its use.

Hunting of Synchronous Apparatus.

At the recent meeting of the Illinois State Electric Association Dr. Ernst J. Berg, professor of electrical engineering at the University of Illinois, presented a paper in which were related some of the author's early experiences relating to the parallel operation of synchronous generators and motors. In one case cited, where two 125-kw alternators were driven by belts from a common line shaft, when the two machines were connected in parallel, the belts would slip and buckle for a few seconds, the ammeters would show an enormous pulsation of current and finally the belts would fly off. An investigation showed that the driving pulleys differed in diameter by 1/16 in. When the pulleys were turned to equal diameters the machines operated satisfactorily.

In another case certain synchronous converters in railway service refused to operate without hunting. After some experimenting it was found that, if the converters could be supplied with energy over lines having very little potential drop, they would work satisfactorily; the more copper connecting the generators with the converters, and the more copper between the converters, the greater was the stability. This relation was

very important theoretically. but could not well be taken advantage of, since the cable system had been planned for duties other than that of keeping converters in step. Fortunately, among the large number of rotaries there were one or two which seemed to be more stable than the others, whether they were running alone from the generators or in pairs. A very careful study was made of these, which were built from the same drawings as all the rest, and it was found that their pole-pieces were slightly warmer than those on the others. This was a very important clew. It took little theorizing to see the reason in this case. The eddies in the poles must constitute a damping brake and, therefore, act to diminish any tendency to pulsation.

The poles of one rotary were "shimmed" and the result was as expected; they became very much hotter, but the rotary was stable. An unexpected situation arose in this connection; it seemed that any of the other rotaries could be run satisfactorily with this one even without "shimming" the other. Shimming seemed to be the solution and the poles of all were shimmed. In connection with this some difficulties were met with, however. It was found that on the rotaries that had the greatest line drop the pole-pieces had to be shimmed to an extent to make the pole-faces almost red hot, which hardly could be considered practical and certainly greatly impaired the efficiency. It was but a short step to find other and better means to obtain the required braking effect. Copper bridges were installed between the poles, and as a later evolution a regular squirrel-cage winding is being inserted in the polefaces. The observation about the effect of line resistance was turned to good advantage in later installations. At the present time it is not expected that satisfactory parallel operation of synchronous machines can be accomplished unless the line resistance is moderate.

It was felt that by using the above remedies the synchronous converter situation was well in hand and that no more difficulties could arise. It was but a very short time later, however, when a whole new set of difficulties arose, and these were in connection with the parallel operation of slow-speed, directly connected alternators. In these cases, as in the cases of synchronous converters, difficulties were encountered almost with the first installation. The conditions furthermore were almost in every case the same. The generators, while at times running perfectly well, would, seemingly without any provocation, begin to see-saw until the cross currents became so large as to cause them to fall out of step. During the hunting energy was transferred periodically from one machine to the other, as was shown by the movements of the electrical instruments and the opening and closing of the steam valves. It was found that by operating the throttle by hand the machines would stay in step, showing that the dashpots of the governors were at fault. The air dashpots were replaced by oil dashpots, thereby impairing the speed regulation, but stopping the hunting. In later constructions the dashpots were provided with by-paths so that they would prevent any sudden small tendencies to speed variation and at the same time be sufficiently sensitive to prevent the speed from getting too high in case the load was suddenly removed.

The oil dashpots cured practically all cases, but they did not solve every case. By systematic investigation still another important remedy was found in eliminating "play" in the various connecting rods between the governor and the steam valves. With a total "play" of only 0.02 in. or 0.03 in. operation would be impossible in many cases. This feature accounts for many erratic hunting tendencies found to-day. In 99 out of 100 cases the generators could be made to operate satisfactorily with these simple modifications of the engines.

With the introduction of turbo-generators it was felt that no difficulties could well occur, since these have very high inertia and always run at uniform speed. Nevertheless, difficulties have been experienced in some rare cases, and it is not unusual to find a slight pulsation of current between two turbo-alternators. These cases have occurred when two or more generators are running in parallel in different stations connected by cables of considerable resistance. At the time these difficulties first arose previous experience and theories very quickly suggested the installation of reactive coils between the individual machines or stations and such coils did check the tendency to hunt.

The author told of two characteristic extreme cases of hunting, one in connection with synchronous converters and the other with synchronous motors. It was found that, although all apparatus of a certain system had been running satisfactorily for years, with the addition of some new water-wheel-driven generators hunting began. When this difficulty arose sufficient was known of the theory of hunting to suspect that the "natural period" of the new machines might be the same as that of some of the old machines, and therefore hunting was likely to occur. The periods were determined and found to be the same. The difficulties were removed by adding a small flywheel to the new machines.

In the other case the natural period of the generators was the same as the number of revolutions of the engines. The trouble could have been remedied by the addition of a small flywheel, or by shimming of the poles, but the central-station man did not want to increase the weight on the bearings nor did he permit shimming, since this would slightly affect the voltage regulation; in fact, he wanted turbo-generators—which he got.

The author remarked that hunting is always associated with pulsation in speed. If the speeds of two synchronous machines at every instant are the same hunting cannot take place. With belt-driven machines such variation may be due to the condition of the belt. With directly connected, slow-speed engine units there is always a slight pulsation in speed during each revolution. With a fairy-wheel capacity there should be little difficulty on this score. When the flywheel is of sufficient size to limit the pulsation in speed to 2.5 electrical space degrees hunting will not take place.

Illinois State Electric Association Convention.

The 1910 convention of the Illinois State Electric Association was held at Rock Island, Ill., Oct. 26 and 27, 1910. Central-station men arriving early were entertained with a smoker and vaudeville at the Harper House on the evening of Oct. 25. Mr. J. H. Delaney, of the Cosmopolitan Electric Company, Chicago, acted as master of ceremonies on this occasion.

Wednesday morning the convention opened on the sixth floor of an office building, the main floor of which is occupied by the offices and display-room of the People's Power Company, of Davenport, Moline and Rock Island. Most of the sixth floor of this building was given over to exhibits and to a large room where the sessions were held. An excellent array of exhibits was provided by the manufacturers. The registration at the convention was 149.

The first session was called to order at 10 a. m. Wednesday by President E. W. Smith, of Kewanee. The first business was the presentation of the membership committee's report by Mr. D. McAfee, of Galesburg, who offered the applications of eighteen central-station companies for membership in the association, which companies were duly elected to membership. On motion of Mr. E. L. Brown it was then voted that the president appoint a committee on resolutions. He mentioned especially for remembrance by the committee the death of a former president of the association, Mr. W. E. McCullough, of Beardstown.

The first paper was one by Mr. W. E. Osborn, advertising manager of the Rockford Electric Company, on "Signs and Window Lighting." In opening the discussion on this paper President Smith called attention to the fact that the convention was opening with the best attendance the association ever had at one of its conventions, and that the opportunities for discussion were unusually good. In the discussion Mr. John G. Learned, of the North Shore Electric Company, Chicago; Mr. T. W. Gregory, of East St. Louis; Prof. E. J. Berg, of Urbana; Mr. R. S. Wallace, of Peoria; Mr. N. M. Argabrite, of

Belvidere, and President Smith told of successful methods they had used to increase revenue from sign and window lighting.

Mr. J. S. Maltman, new business manager of the Kankakee Gas & Electric Company, read a paper entitled "The Radical Tendency in Rates." In it he objected to imposing a large fixed readiness-to-serve charge upon the consumer, and also urged simplicity in rate systems. This stirred up considerable discussion, an account of which is given elsewhere in this issue. The general sentiment was in favor of a recognition of the principle in rate-making that higher rates must be made to consumers with a low load-factor than to those with a high load-factor. Mr. Maltman explained that his paper did not intend to attack this principle, but his objection was raised to its application of a high readiness-to-serve charge which would scare away customers.

"Electric Shows in Small Cities" was the title of a paper in which Mr. J. E. Johnson, general superintendent of the Danville Railway & Light Company, told of the experience of his company in putting through an electric show. Mr. E. W. Smith related an experiment of his along the same line two years ago, and he was followed by Messrs. A. G. Mosier; Bass, of Bloomington; Gregory, of East St. Louis; Bell, of Granite City, and others. The president then announced the appointment of a committee on resolutions as follows: Mr. F. M. Sinsabaugh, of Carrollton; E. L. Brown, of Elmwood, and Mr. F. J. Baker, of Chicago.

The Wednesday afternoon session was opened with a paper by Mr. T. P. Pinckard, new business manager of the Peoria Gas & Electric Company, on "Promoting New Business." This was immediately followed with a paper by Mr. Max Heiliger, assistant manager of the Rockford Electric Company, on "How to Get New Business." These two papers were discussed together. The discussion hinged mainly about Mr. Pinckard's contention that extensive free trials of devices and spectacular methods of selling articles below cost were not good, sound business for a substantial organization like an electric light company.

The chairman of the rate committee, Mr. R. S. Wallace, presented the first report of that committee, which was a summary of the various rate systems in use, containing an appendix giving an example of the working out of a rate and references to various articles recently appearing on the subject of rates and commission decisions, the majority of references being to articles in the *Electrical World*. The report recommended a differential rate which consists of two elements—the element of fixed charges and the element of variable or operating charges. It gave examples of determining fixed and variable charges. The general principle of the differential rate only was advocated without recommending details as to methods of applying it. The committee consisted of representative men from large and small plants in the State. Its membership was as follows: Mr. R. S. Wallace, of Peoria, chairman; Mr. J. J. Frey, of Hillsboro; Mr. Geo. W. Burton, of Danville; Mr. E. L. Brown, of Elmwood; Mr. S. B. Cushing, of Chicago. After the reading of the report the committee was continued for two years. The discussion which followed was on the importance of uniform accounting in order to determine rates and also on the general principle of the differential rate, with which most of the speakers were in accord. An abstract of this discussion appears elsewhere in this issue.

The president then introduced Mr. L. D. Mathes, of Dubuque, Ia., as ex-president of the Iowa Electrical Association. Mr. Mathes made a few pleasant remarks in his very original way about the relations between the central-station men of the two neighboring States, and then discussed some of the new-business ideas advanced in Mr. Pinckard's paper.

Mr. P. B. Sawyer, manager of the Des Moines Electric Company, another visiting Iowa central-station man, was also introduced. Mr. E. L. Brown spoke briefly on the importance of adopting a standard system of accounts. Secretary H. E. Chubbuck then requested Mr. J. R. Cravath, of Chicago, to give the association a short talk on the indirect system of illumination, of which he said he had seen some very fine examples recently in Chicago. Following Mr. Cravath's remarks the president announced that the registration to date was 133 central-station men, which announcement was received with much applause.

A paper on "New-Business Ideas," by Mr. O. C. Macey, superintendent of the Alton Gas & Electric Company, was then read. After some further discussion of new-business topics the nominating committee was appointed by the president as follows: Messrs. E. L. Brown, of Elmwood; John G. Learned, Chicago, and N. M. Argabrite, of Belvidere.

The Thursday morning session was opened with a paper by Mr. P. B. Sawyer, general manager of the Des Moines Electric Company, on the Des Moines plan of meter reading. This described how the meter reading and billing are carried on continuously throughout the month. This aroused considerable discussion on meter and billing methods. Among those who told of their methods were Messrs. Frank J. Baker, of the North Shore Electric Company, Chicago; E. McDonald, of Lincoln; John F. Gilchrist, of the Commonwealth Edison Company, Chicago; E. L. Brown, of Elmwood; J. J. Frey, of Hillsboro and Collinsville; R. S. Wallace, of Peoria; N. M. Argabrite, of Belvidere; E. W. Smith, of Kewanee, and C. W. King, of Lewistown.

Dr. E. J. Berg, professor of electrical engineering at the University of Illinois, Urbana, gave an interesting account of his experiences in curing the hunting of synchronous apparatus at various times during his connection with the General Electric Company, an abstract of which appears elsewhere in this issue.

Mr. C. W. Lee, of New York, then presented a paper on "Publicity and Public Policy," urging that public service companies give more publicity to some of the essential facts concerning their business in order to prevent the agitation which sometimes arises because of the mystery surrounding the business. He was followed by Mr. John F. Gilchrist, of Chicago, and Mr. Thomas Crawford, president of the Iowa Electrical Association. Mr. L. D. Mathes, of Dubuque, Ia., urged that companies be reasonably right with the public before asking for favors. This friendship must be cultivated in advance and not worked up temporarily when the company has its hand out asking for favors.

The association then went into executive session for the transaction of the remaining business of the convention. In this session the following officers were elected for the ensuing year: President, Mr. W. G. Austin, of Effingham; first vice-president, Mr. H. A. Foster, of Fairbury; second vice-president, Mr. J. J. Frey, Hillsboro; third vice-president, Mr. F. H. Golding, Rockford; fourth vice-president, Mr. E. MacDonald, Lincoln; secretary, Mr. H. E. Chubbuck, Peoria; assistant secretary, Mr. C. A. Willoughby, Peoria; treasurer, Mr. F. Reimert, Rock Island. Executive committee: Messrs. W. B. McKinley, Champaign; R. S. Wallace, Peoria; Frank J. Baker, Chicago; F. M. Sinsabaugh, Carrollton, and E. W. Smith, Kewanee. A motion was also passed recommending the N. E. L. A. standard accounting system to member companies.

The supply men entertained the convention at the smoker and vaudeville Tuesday evening, and there was a theater party Wednesday evening, the latter, however, proving somewhat of a disappointment to those giving it on account of the quality of the play presented.

Thursday afternoon the convention was taken in hand by the People's Power Company, of Rock Island, of which Mr. J. F. Porter is president, and was royally entertained, first by a trip through the Rock Island arsenal, and then across the dam to the plant of the People's Power Company in Moline. After that special cars were provided to take the party out to the historical resort on the bluffs of the Rock River known as "Blackhawk's Watch Tower." A fine banquet was there spread, and this was followed by toasts in which both the local and convention talent participated.

The Rate and Accounting Questions at the Illinois Convention.

At the convention of the Illinois State Electric Association at Rock Island, Ill., Oct. 26 and 27, a general account of which appears elsewhere, considerable discussion was engendered on the subject of rates. The first paper on this subject was entitled "The Radical Tendency in Rates," by Mr. J. S. Maltman, new business manager of the Kankakee Electric Light Company. Mr. Maltman made a plea for simplicity in rates and claimed that we cannot get down to the exact cost of service to each consumer and cannot ever approximate it, as the diversity factor plays too important a part. He questioned the policy of adopting an elaborate rate based on cost of service plus cost of energy, for even if just and equitable the public would not understand it. For example, if a house were wired for electricity and piped for gas, and a man should have to pay $2 for electric service plus a small rate for energy, would not a large number of prospects have only the gas connected? Mr. Maltman considered that lamps of 0.1 watt per candle which have been suggested lately would be the greatest revenue producers the central station ever got hold of. He said that he did not know of a consumer in his city who had reduced his bill through the use of tungsten lamps, and there are as many tungstens in proportion to population as in any city of the country.

If the consumer's bill is greater than he expects to pay he kicks, and if it goes under he uses light more liberally. One large consumer, and a chronic kicker on the amount of the bills, changed over to tungsten lamps, and, though the bills gradually increased until they were materially larger than before, the consumer said he was perfectly satisfied, as he felt he is now getting his money's worth, whereas before he did not.

In the discussion of the paper Mr. J. R. Cravath, of Chicago, said that we could not get away from the fact that electrical energy under certain conditions costs a certain amount delivered, and that unless our methods of selling vary according to cost of production and delivery some electrical energy will be sold below cost. The system of charging involving a fixed readiness-to-serve charge, plus a variable operating charge, had never to his knowledge been extensively and successfully used in residence lighting business. The consumer objects to the high fixed charge. On the other hand, in commercial lighting it had been the means of building up business and meeting competition in many places.

Mr. Linn, of Bloomington, said that his company had since Jan. 1 a two-rate system in effect. Part of the energy is charged at a high primary rate and part at a low secondary rate. They are now trying to educate merchants to the fact that the secondary rate is low and that they can get more for their money by using electricity more hours per day. The rate in the business district is 10 cents per kw-hour up to an equivalent of three hours per day of the connected load, and 5 cents for electricity in excess of that.

Mr. Frank J. Baker, of the North Shore Electric Company, Chicago, said that the method of having a maximum-demand meter for each consumer involved too great an investment. His company takes a certain percentage of the connected load as the estimated maximum demand, but does not count heating and other day-load appliances. This percentage is based on actual experience from the measurement of several thousand customers in Chicago. In making this estimate no account is taken of the heating appliances connected, which thus usually get the low secondary portion of the rate and this makes them economical to the householder. He thought it important that the association should agree, not on the rates themselves, but on the principles and systems of charging to be employed.

Mr. N. M. Argabrite said that his company in applying the two-rate system did not count heating appliances. The connected load is invoiced once each year. Mr. E. W. Osborn, of the Rockford Electric Company, said that his company had a two-rate system of 13.3 cents and 6.6 cents in use in the business district in Rockford, while in the residence district the rate is a uniform meter rate. Mr. Baker objected to this practice, because he said that it discouraged the use of flatirons, vacuum cleaners and other profitable day-load devices, by forcing them on a high rate. He further said that his company so thoroughly believes in the flatiron business that it now exchanges flatirons on the same basis that it exchanges lamps; that is, if the consumer brings back a defective iron he will be given a good one in its place.

Mr. John G. Learned, of Chicago, thought that companies not having a primary and secondary rate were losing by it, because the secondary rate encourages off-peak use of electricity. Among 16,000 customers his company has placed 5000 flatirons. The argument that one can use these flatirons at the low rate is a strong one. Mr. E. McDonald, of Lincoln, said that he had trouble in getting the maximum load of various customers because of changes from time to time, especially among merchants the few weeks before the holidays. Mr. Argabrite thought that there should be no trouble with this. If a merchant has his store properly lighted there is no reason why he should change his lighting during the holidays.

Mr. Thompson, of Peoria, told of an experiment made at San Antonio, Tex., to determine a basis of estimating maximum demand according to the number of rooms in a house. By taking all the houses in a certain district, they worked out an average of one 16-cp lamp for each room or hall, without regard to size or number of lamps on the chandelier. Mr. T. W. Gregory, of East St. Louis, also thought that central-station companies not using a primary and secondary rate are losing much good business. Mr. Maltman explained that he did not in his paper intend to criticise the differential or maximum-demand rate with a primary and a secondary portion, as his company employs such a rate. What he objected to was a high fixed charge independent of the kw-hours consumed.

Mr. Monroe, of Streator, told of a rapid new-business campaign carried on in that town, which last spring had only eighty residences connected for 20,000 population, and where business had been increased 140 per cent since June 1. It was simply a question of educating the public. He touched on the importance of teaching consumers the necessity of washing shades and reflectors, having them learn to figure bills and keep their own meter readings in order to obviate complaints. Consumers would gladly pay a high rate if only educated up to the convenience and importance of the service.

Mr. H. R. Kingman, of Mount Vernon, said that the question of the actual rate is not of so much importance as whether all consumers are getting the same rates. A man does not object to paying a fairly high rate if he knows that every one else is paying the same thing. It is the discrimination that makes trouble. He advised companies to get ready for the establishment of a commission in Illinois.

The report of the committee on rates was followed by a lengthy discussion. The report pointed out that the problem is to determine the general principles that applied to a concrete case will result in a schedule of rates that is equitable practical and legal. After describing briefly the flat rate, uniform rate, sliding-scale meter rate, step-scale meter rate and pyramid-scale meter rate, it finally took up the differential rate, which in general is the form it advocated. This rate it defined as one in which the price per unit of electricity used varies with the consumer's monthly or yearly load factor. Schedules of this type are the results of attempts to devise a rate which will divide equitably among the users of electricity the cost incident to serving them. It is the unanimous conclusion of all who have studied the subject of rate making that rates if equitable must bear a definite relation to load factor. One method of applying the differential rate is to charge the consumer with a portion of the electricity used at a high or primary rate and the balance at a lower rate or rates. The number of units for which the consumer is charged at the high rate may be determined by, first, a maximum demand indicator, or second, the amount of the consumer's connected load, or third, his estimated maximum demand. In the readiness-to-serve rate the consumer is charged with a fixed amount, which consists of two items, a demand charge proportional to the size of his

installation and a consumer charge, which is the same for all consumers. In addition to this fixed charge there is an additional charge for electricity used at a relatively low price per unit. A percentage of the connected load is used by some in determining the estimated maximum demand. Still others use the number of rooms regardless of the number of lamps installed; some do not include heating devices; others use the floor area lighted as the basis of demand.

The committee realized that rates adopted as a result of its recommendation might later be subjected to the scrutiny of a commission or the courts. The basis of a system of rates must be such that the resulting rate schedule will bear proper relation to the cost of service, so that each user of service shall pay the cost incident to his requirement and in addition thereto a reasonable profit. It is impracticable to devise a schedule which will assess to each consumer the exact cost of the service rendered him, but a system of rates which approaches this condition is preferable to one in which there is no intent that the rate shall bear any definite relation to the cost.

It concludes that a system in which the cost of service is recognized, which has been successfully defended in the courts and which has been declared correct in principle by public bodies exercising regulatory powers can be safely adopted. The committee recommended therefore the differential rate system, fully believing that after a careful analysis of cost and segregation of consumers' accounts a schedule of differential rates can be devised for any company that will prove equitable, practicable, expedient and legal. The exact form of differential rate, whether to Wright maximum demand, multiple rate or readiness-to-serve, must be decided with due regard to local conditions. The committee gave as an appendix to its report a list of rates prepared by the secretary during the past year. There are but three differential rates in the list of twenty, from which it would appear that many rates have been arbitrarily fixed without regard to any factor except expediency and perhaps necessity.

The basis of the differential rate is in the fact that electricity cannot be stored, and there is, therefore, one class of expenses that is independent of output and another class that is dependent upon output. The former may be named fixed cost and the latter variable cost. The usual items of expense may be grouped under two headings as follows: Under fixed cost, interest, taxes, insurance and depreciation. Under variable cost, fuel, labor, supplies, repairs and maintenance, distribution expense, general expense. Each of the variable costs has a fixed element in it. For instance, the fuel consumption may be one-third as much at no load as at full load. The labor may be nearly as much whether one generator or all are operating.

As an illustration of one method of determining a differential rate, the committee gave figures for a station having a capacity of 400 kw located in a town of 10,000 inhabitants. Interest was figured at 6 per cent on the whole investment. Insurance and taxes were figured as 1 per cent on land, 1.5 per cent on buildings, 1 per cent on mechanical plant, 1 per cent on electrical plant and 0.5 per cent on pole lines. Depreciation was figured as 2.5 per cent on buildings, 6 per cent on mechanical plants, 6 per cent on electrical plant and 4.5 per cent on lines.

The total station investment was figured at $60,000, or $150 per kilowatt of capacity. The fixed charges per year would amount to $6,600 on the station investment. The investment for the distribution system was assumed as $118,350, or $296 per kilowatt. The total operating cost was assumed to be $25,975. Of this 63.5 per cent does not change with the output and 36.5 does so change. In other words, two-thirds of the variable cost is caused by being ready to serve the customer without notice. Adding the fixed operating cost to the other fixed charges, such as interest and depreciation, gives a total annual cost of $35,667.50 for the fixed portion and $9,468 for the variable portion of the cost. Analyzing this cost further, the conclusion is reached that a rate of 6 cents per kw-hour for street lighting and 11 cents per kw-hour for business and residential lighting would yield the station a net profit of 10 per cent.

However, a rate of 11 cents per kw-hour is not fair to all, unless each customer uses his maximum demand the same number of hours per day and the load on the station is kept constant throughout the twenty-four hours. For the business and residence lighting the maximum station load is 300 kw, and the kw-hours sold by the consumers' meters is 345,452. This makes the load factor for the year for this class of business 13.2 per cent, or 3.2 hours' use per day of the maximum demand. From this it is deduced that the total revenue from business and residence lighting, $36,517.25, is made up of two elements, one being the fixed revenue of $29,638.95, which, divided by the output, gives 9 cents per kw-hour. The other element is a variable, which is $6,878.30, which, divided by the output, gives 2 cents per kw-hour. The rates, if adjusted so as to give 11 cents for three hours' use per day of the maximum demand, might be arranged as follows: First hour, 15 cents; second hour, 9 cents; third hour, 9 cents. Total three hours, 33 cents; average, 11 cents.

In the discussion on the committee's report Mr. Frank J. Baker, general manager of the North Shore Electric Company, Chicago, urged the necessity of the adoption of uniform systems of accounting in order to determine rates. He announced that his company had decided to adopt the standard system recommended by the National Electric Light Association. This association has recently printed books for its members giving its standard classification of accounts. The Commonwealth Edison Company, of Chicago, is also seriously considering changing its extensive system of accounting to conform to the N. E. L. A. standard.

Mr. E. J. Condon, president of the central-station company at Harvard, Ill., did not favor the association taking any action on a standard accounting system at present, because of the possibility that a state commission, if established, might change or require a change in such system. In reply Mr. Baker said that if the companies of the State to a considerable number now adopt the system adopted by the National Electric Light Association a commission would probably accept the system rather than formulate something new. If, however, the companies of the State have not agreed on anything, the probability would be much greater that the commission would formulate a system of its own. The N. E. L. A. system has been the result of several years' work by some of the best electric light accountants of the country working close to the commissions of the State of New York. The form adopted is very similar to that required in New York and Wisconsin. The system as it would be adopted by small companies using only the main headings would be very simple. Mr. N. M. Argabrite, of Belvidere, announced that his company had just changed to the N. E. L. A. system. The only expense had been that for a few forms. The system is easy to follow. He considered it safe to say that no better brains would be put into devising an accounting system in Illinois than had already been put into this National Electric Light Association system.

In a later session the question of standard accounting was again brought up, and a resolution was passed recommending that the companies of the State adopt the N. E. L. A. system as far as possible. A number of companies reported having either adopted the system or having decided to adopt it at the beginning of the next fiscal year. It was pointed out that only eight general headings of operating expense accounts are required by the N. E. L. A. system, and three of these are not for items with which the smaller companies are concerned, so that practically only five headings would have to be kept in the majority of cases.

Discussion on Rate Schedules at Empire State Meeting.

A paper on the subject of rate schedules was read by Mr. James T. Hutchings, general manager, Rochester Railway & Light Company, at the annual meeting of the Empire State Gas and Electric Association, New York, on Oct. 5.

Mr. Hutchings said that in many respects the sale and price

of electricity for light, heat and power are governed by the same conditions as the sale of any other commodity: First, by the cost; second, by competition or the price at which a similar article can be purchased; third, by the fact that the lower the price to a certain extent, the greater would be the amount of sales.

It must be remembered that electricity in all of its various fields has keen competition. In the case of the small customer electric light has the competition of kerosene oil, illuminating gas and various types of gasoline-lighting systems. In the larger plants there is the competition of illuminating gas and the private power plant. The same condition holds true in the power field for both the large and small customer.

Mr. Hutchings desired to bring out only a few of the many points which must have consideration in any rate scheme. In the inception of any enterprise the price asked for the product is based upon the demand, what has been previously charged for the product which is replaced, and the cost of production. But after the early stages have been passed the question to be confronted is, Upon what system is the charge now based? Following are a few systems in effect at the present time:

First—A flat charge of $—— per month per kilowatt of maximum demand or connected load.

Second—A flat charge of —— cents per kw-hour.

Third—A flat charge of —— cents per kw-hour, subject to varying rates of discount for quantity.

Fourth—A charge of $—— per kilowatt of maximum demand, plus a flat charge of —— cents per kw-hour.

Fifth—A customer charge plus demand plus flat charge per kw-hour.

Sixth—Making use of the fourth and fifth methods, and, in addition, a discount for quantity.

Lastly—Innumerable combinations of the foregoing.

All of these different schemes are used with varying unit prices for both lamps and motors. Mr. Hutchings then considered the advantages to be obtained by each system outlined in the foregoing:

First—This is very satisfactory to the customer if the flat price is low enough and his use long enough. It is also very satisfactory to the company if the price is high enough and the customer's use is short. Should all of any company's business, however, be sold upon this basis at a profit, the company would be losing money on all of its long-hour business and the price would be so high that the company would be unable to supply short-hour business. This scheme of charge has been most advantageous to companies generating their electricity hydraulically, as in this case a very large proportion of the cost of delivering energy depends entirely upon the capacity of the plant; it makes little or no difference whether the load is carried one or twenty-four hours per day. Where generation is by steam, if a flat price is charged sufficiently high to make a customer using energy twenty-four hours per day profitable, this price is too high to obtain the business of a short-hour customer.

Second—This scheme of charge has been made very popular with many of the lighting companies, most of the older companies having passed from the flat-rate scheme to the meter rate upon the development of a satisfactory electric meter. A company, however, selling energy upon this basis only will be unable to make a price which will return a profit upon the short-hour customer and obtain the business of the long-hour customer; in other words, a company selling energy upon this basis would have a very poor load-factor and would have only the extremely short-hour customer. This scheme has, however, the advantage of being easily understood by the customer and is very easily billed by the company.

Third—This scheme is subject to all of the defects of the foregoing, and, if carried out, will have a tendency to load up the central station with a very large plant investment and a poor load-factor, as it does not take into consideration the fact that it is much cheaper to sell 1000 kw-hours to the customer having 1 kw of capacity or maximum demand, as against an equal sale of 1000 kw-hours with a maximum demand or capacity of 10 kw. It, however, has the advantage over the preceding systems of being very simple and appealing to the customer.

Fourth—This scheme is quite satisfactory, although somewhat more complicated. If properly explained to the customer it is possible to improve very materially the load-factor of the station and to enable the customer to earn a very low rate per kw-hour of energy used. This system of charge, if properly worked out, will bring to the company all of the long-hour business; in other words, all of the business which is most profitable to the company. In competition with the private plant it must be remembered that the cost of central-station power house and distribution system per kilowatt of maximum demand will generally be twice that of a private plant of the same capacity, so that the fixed charge, which holds whether the plant is operated or not, would be twice as much for the central station as for the isolated plant. For this reason the central station is somewhat handicapped on the very short-hour business, whereas owing to its lower operating costs and diversity factor it has a considerable advantage in bidding for the long-hour business. This scheme, however, does not take into consideration the fact that there is a distinct cost per customer regardless of the amount of business done.

Fifth—This system takes into consideration the cost of serving a customer as a customer, also the cost of serving per maximum demand, and the cost of producing energy per kw-hour. It is somewhat more complicated than the preceding one, but is in theory more equitable.

Sixth—The use of a discount for quantity in connection with the foregoing systems of charge (fourth and fifth) is justifiable, first, because there is a difference in cost between delivering a large and small amount of energy to any particular point other than the pure customer cost. But the main reason is to secure the business. How far this discount should go is determined very largely by competition. Mr. Hutchings believes, however, that the central station should make a profit on all of its business; that is, it should take no business at a price so low as to incur loss, after taking into consideration everything which enters into the cost of delivering energy to the particular customer. In determining what is the lowest price at which energy can be sold under any particular load factor, total average costs, as shown by the company's books, are absolutely unreliable. Mr. Hutchings took as an illustration a community of 10,000 people supplied by a central station having a contract with the city for street lighting and doing a general commercial business. There is located in this city one very large manufacturing industry upon which the prosperity of the community very largely depends. The energy required to operate this one industry is equal in kw-hours to the total business now being furnished—the load-factor of this industry being 40 per cent, whereas the present load-factor of the central station is about 30 per cent. The question comes home to the central station: "Why can we not obtain this business, and how far shall we go in making the price for this industry lower than that quoted to our present business?"

Before entering into negotiations the cost to the present industry to generate its own electricity should be ascertained, if possible. A very careful estimate should then be made of how much additional plant would be required on the part of the central station to supply this load, and how much more is would cost to operate this plant after taking on the larger customer. Any profit which can be made after payment of the additional operating expense and the additional fixed charge of interest on the capital invested, depreciation and taxes is pure profit, and if there is no profit shown between company cost and the customer's cost the business should not be taken. If, however, there is a profit the system of charge for this large business should be made on a basis which will return as close a price as possible to the cost to the private plant, taking into consideration such improvements as the company engineers may know could be made therein. In other words, the price quoted should be such as to hold the business permanently, as one cannot afford to take this business over unless there is a good guaran-

tee that it will be held for a number of years. In justification of this method it is known that every time output has been doubled there has been a reduction in unit cost, both per kilowatt of maximum demand and kw-hour.

The question of rates is so complicated that Mr. Hutchings feels this subject should receive a great deal of thought and investigation. Central station costs should be analyzed to the minutest detail, having regard to their relation to the cost of carrying the maximum peak load and the cost of delivering per kw-hour.

Mr. Hutchings feels that any company that has not a complete published schedule of rates is in a very unfortunate condition, and that whatever the rate system is it should be possible for the customer to obtain as good results by negotiating with the office boy as with the general manager, and the office boy should have just as much latitude and no more than the general manager.

Discussion.

The presentation of the paper of Mr. Hutchings was followed by a joint discussion by Mr. John C. Parker, mechanical and electrical engineer, and Mr. H. C. Deffenbaugh, of the Rochester company.

Messrs. Parker and Deffenbaugh had found that the existing rate schedule of their company, consisting of a sliding scale with a progressive discount for large customers, contained certain anomalies and did not automatically favor that class of business which is the cheapest to supply, namely, the off-peak business.

It was their feeling that it is inequitable to favor such business by making class rates, whereunder storage-battery charging at night may receive an exceptionally good rate, which is not received by some other business using the service in an identical manner, but not falling under the same nominal classification.

They therefore attempted to formulate a schedule of rates whereunder the charge should be based entirely upon the way in which the service is utilized, rather than upon the use to which it is put. To do this they studied the costs of production and the competitive cost of isolated-plant energy, with a view to determining the way in which the various component items should be arrived at. The cost of service and the competitive cost were found to consist of three items:

First—A customer charge, "A," independent of the size of the customer.

Second—A demand charge, "B," per kilowatt over and above the customer charge and irrespective of the amount of energy used.

Third—An energy charge, "C," per kw-hour over and above the "A" and "B" charges and dependent only upon the energy consumption.

As the "B" charge is largely dependent upon the apparatus which has to be installed to meet the maximum demand for service, and as this demand is occasioned by the "peak" customers during the winter months, and as the apparatus provided therefor is idle during the non-peak or summer months, the "B" charge should be a graded one—heaviest during the winter months, lightest during the summer months—the sum of such graded charges being equal to the annual "B" charge, which is determined upon as being a fair one per kilowatt of demand.

In this way a strong incentive will be created to the use of motors during the summer months for such purposes as refrigeration, brewery use, etc., and a strong deterrent will discourage use during the peak or will, at least, compel it to bear its proper share of the expense.

Remittance of a part of the "B" charge is contemplated during off-peak hours in the various months in cases where the customers are willing to pay a nominal sum, covering the cost of metering.

This would encourage those classes of business that can advantageously keep off the peak, and would, if applied to domestic service, constitute a strong and logical inducement to the use of electric flatirons, vacuum cleaners, cooking devices, etc., without necessitating the making of one class rate for cooking, another for flatirons, another for lighting etc.

By this means one of the chief objections to the "A," "B," "C" system could be met and encouragement given to profitable residence business, since, in view of the fact that the energy charge is only a small portion of the total service charge, additional use of devices will cost but little, and it will, therefore, be readily possible for customers to double or triple the amount of satisfaction they can receive from central-station service, and this in a degree much greater than the slight increase in their bills which will be necessary in order to render the service profitable.

Messrs. Parker and Deffenbaugh do not believe that it is right that any class of service should be supplied at a loss. The fact that the company is at present constrained so to do with its residence consumers is, after all, only an expression of the fundamental note of socialism, "To every man according to his needs; from every man according to his ability." The energy charge under an A, B, C system could be cut nearly in two if the company were freed from the losses resultant from its short-hour business. The fact that the long-hour customers are compelled to pay for the cheap service secured by the residence customers would not be so bad, if it resulted only in a redistribution of the wealth of the community—in a saving to the householder at the expense of the industrial consumer—but the fact is that the burden which the industrial consumer is compelled to carry for the benefit of the losing business, represented by the householder, deters not a few of them from utilizing central-station service and compels them to install isolated plants, thereby rendering impossible a conservation by the community of its total wealth and working an economic wrong to the community.

As an illustration of the simplicity of the A, B, C system, as suggested, a tentative model bill was shown, as follows:

Customer charge .....$——
— kilowatts demand at $— ..... ——
— kw-hours of energy at — cents..... ——
——
Total service charge.....$——

This is much more direct and simple for the clerical force than are any of the present sliding schedules and is more readily comprehensible by the public.

In arriving at the service cost each of the account numbers specified by the Public Service Commission was analyzed to determine what part of it was occasioned by the customer charge, what part by the demand and what part by the energy used.

For example, most of the coal consumption is dependent on the kw-hours used, but a part of it, namely, the stand-by and banking coal, is dependent on the size of the plant; that is, on the total demand. Therefore, the coal burned per month was plotted against the kw-hours generated per month. From this there was obtained a shotgun curve and a line was dropped in, passing fairly through all the points. By notation of the pounds of coal per month corresponding to a "zero" kw-hour generation it was determined how much of the coal should enter into the "B" element of the cost and how much into the "C" element.

Similarly, the other items of expense were determined. Power-house equipment, storage batteries, general supervision of these details, etc., would be almost, if not entirely, demand expenses. A large part of the meter cost is a customer expense. The distributing system consists entirely of customer and demand expense, the customer expense being that part which would be occasioned by serving each customer with the minimum size of wire mechanically practical, but delivering no energy over this wire. All the rest of the distribution expense would appear as "B" cost, and its aggregate divided by the aggregate demand is the distribution expense per kilowatt of demand.

Of course, due weight must be given to the diversity factor in deciding how much cost attaches to each customer-kilowatt. It must also be recognized that conditions would be radically

different in different towns, so that a distribution that would work out fairly well in Rochester, where there is a combination of hydraulic generation, steam generation and energy purchased under a demand schedule, would be absolutely inequitable in a city where the generation was purely hydraulic, or, again, in a city where nothing but steam supply was to be found.

Certain items of expense, such as commercial and advertising costs, are indeterminate in their distribution among the three items of charge. They should, therefore, be thrown into that item, or those items, which can best bear them under competition.

Bond interest and preferred-stock dividends, being a function of the size of the plant, should be accounted as demand or "B" costs. Common-stock dividends, representing in part, at least, the "velvet" of the concern, should be distributed proportionately over all three items of the charge, or should be thrown on to that part of the business best capable of bearing the addition, always provided that part of the charge will return enough to constitute an attractive profit to the stockholders.

Before instituting such a rate system, especially with reference to the graded "B" charges, due weight should be given to their reactive effect on the company's business; that is, the "B" charge should not be made so low in the summer, for example, as to create a summer peak and a winter "valley." Sound commercial judgment will dictate just how much of an inducement will attract the customers to the off-peak periods, and the inducement should not, in the nature of things, be made any greater than this; otherwise a very undesirable result will ensue.

Discussion.

The general discussion which followed was participated in by the following: Messrs. Lawrent Heaton, Orange County Lighting Company; A. E. Forstall, New York City; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; T. R. Beal, Poughkeepsie Light, Heat & Power Company; Percy Thomas; John T. Smith, Southern Dutchess Gas & Electric Company; A. S. Ives, Poughkeepsie Light, Heat & Power Company; E. H. Palmer, Interurban Gas Company; R. M. Searle Rochester Railway & Light Company, and George L. Colgate, Canandaigua Gas Light Company.

Some of those who discussed the subject did not agree with all the conclusions reached by Mr. Hutchings and expressed the opinion that their own methods of rate-making were more satisfactory.

New York Commission News.

The Public Service Commission, Second District, has granted its first permission for capitalization in connection with the telephone companies under its jurisdiction. The commission has consented and approved of the issue of consolidated first mortgage 5 per cent gold bonds of the Auburn Telephone Company in the amount of $200,000, divided into two denominations of $100 and $1,000 respectively. Provision is made that the holders of the bonds of the denomination of $1,000 be given an opportunity to exchange their bonds for those of the denomination of $100. Bonds are to be issued to retire outstanding bonds, it being provided that exchange of bonds must be par for par in the aggregate amount.

The Syracuse Lighting Company has made a complaint to the Public Service Commission, Second District, directed against the Union Rental Company, of Syracuse, alleging that the company has constructed an electric light plant and is engaged in the business of manufacturing and selling electricity for lighting purposes in the City of Syracuse and not exclusively for its own use or the use of its tenants, and as such is an electrical corporation within the definition of the Public Service Commission's law, and that the company secured a franchise from the City of Syracuse on March 8, 1909, whereby it has laid its wires in a subway under one of the public streets. The complainant alleges that the company is unlawfully exercising its franchise, not having received the approval of the Public Service Commission for the exercise of the franchise. The complaint has been served upon the Union Rental Company and an order made to show cause why the commission should not proceed to procure a judgment of the Supreme Court restraining the defendant from exercising the franchise and from performing any and all other acts as an electrical corporation without the consent or permission of the commission.

Mr. M. W. Gregory, of Morristown, St. Lawrence County, has been authorized to begin construction of an electric light plant in that village and to exercise a franchise granted him.

Maryland Commission News.

The Maryland Public Service Commission spent last week in the discussion of the new schedule of rates proposed by the Chesapeake & Potomac Telephone Company for its subscribers in Baltimore and the surrounding suburbs, which reduces the rate for restricted calls, but does away entirely with the unlimited service in the business district. A number of citizens appeared before the commission during the past week and numerous complaints by letter have been made against the proposed schedule. Messrs. Joseph L. Downes and Laurence M. Miller, general agents for the Northwestern Mutual Life Insurance Company, asked that the commission shall not take action until after it has investigated the technical conditions of the telephone business, the cost of operation, etc. Mr. Francis I. Mooney, an attorney, recommends that the company shall not be permitted to charge more than 5 cents a call. He says that he now pays $2.50 a month for thirty calls, the amount being a little more than 8 cents a call. The proposed rate for the same telephone is not quite 7 cents a call. When complaint was made Mr. Mooney says he was informed that he was only paying 5 cents a call, the extra $1 a month being for the use of the service. Mr. Enoch Harlan, a member of the bar, states to the commission in a letter that he is the author of the bill introduced at the last session of the Legislature by Senator Linthicum designed to regulate telephone rates in Baltimore City; that while the bill was pending he had several interviews with the officials of the telephone company and their counsel, and believes that the measure embodies features which should guide the commission in reaching a conclusion upon the matter of properly regulating the telephone charges. Mr. Harlan believes that the company should grant unlimited service until it perfects such a device as would register each call in the subscriber's home or office, and that if subscribers do not get the party called a charge of not over 1 cent shall be made. He further believes that the price per call after the maintenance charge of $12 per year is provided for shall be the same to the subscriber who uses fifty calls as to the one who uses 5000 per year. In his letter he also makes the statement that the telephone company put a stenographer on his telephone after his bill had been introduced who listened and reported his conversations concerning the bill to the company. She also kept an accurate account of the number of calls he made and the length of time that he talked. A record kept by the stenographer was appended to his letter.

The Coach Owners and Undertakers' Association, of Baltimore, also sent a long letter to the Public Service Commission protesting against the proposal of the Chesapeake & Potomac Telephone Company to discontinue its unlimited service. The association has fifty members representing a combined capital of something like $1,000,000. The letter states that the proposed rates are highly excessive, and urges that the commission shall place the cost of tolls at no more than 2 cents each. Mr. John F. Frazer, Jr., with offices in the American Building, called the attention of the commission to the fact that in addition to paying high rates for telephone service he is also charged for the wire, or a portion of it, that runs along Bellona Avenue, near Charles Street, where he lives.

Massachusetts Commission News.

Governor Draper has issued a statement regarding the tendering of his good offices to the Massachusetts Railroad Commission in connection with the Boston & Eastern Electric Railroad Company's petition for a certificate of exigency from the board. He stated that he has conferred with the majority of the Railroad Commission, Messrs. Bishop and White, and urged them to give an immediate decision, if possible, upon the case in hand. The two commissioners still feel that a present decision would be improper in the face of investigations now going forward, and refuse to take any action in the case. It is doubtful if any action of the board within recent years has aroused so much hostile criticism, and in some quarters an effort is being made to make political capital out of the situation. The Boston & Eastern company has been endeavoring for over four years to gain an entrance into Boston in order to furnish high-speed electric service to and from the densely populated communities of the North Shore, and the feeling is general that the matter ought to be decided one way or the other without further delay.

The Railroad Commission expected to give a hearing on Nov. 1 upon the various Boston rapid transit matters before it, in connection with the Boston Transit Commission, sitting with it. The Boston Elevated Railway Company's side of the case was planned for presentation at this hearing.

The Massachusetts Gas and Electric Light Commission has issued a pamphlet containing the General Laws of Massachusetts relating to the manufacture and sale of gas and electricity, revised to July, 1910. The compilation requires 225 pages of closely printed text, and has been prepared for the convenience of parties interested and with special reference to the jurisdiction and duties of the board. In the absence of a codification of the laws in question the text is made up primarily of certain chapters of the Revised Laws. The act of 1910 relative to the abatement of smoke in Boston, Brookline, Cambridge, Chelsea, Everett and Somerville imposes the duty of administering it upon the board, and is therefore printed in full. As a matter of convenience and interest a table of all special laws relating to the manufacture and sale of gas and electricity has been added, including special laws enacted in 1910. A valuable feature of the compilation is the enclosure in brackets of sections of the law which have been repealed and words which have been stricken out, while new or substituted sections and words are printed in italics. The special laws are arranged chronologically and the compilation is provided with an excellent index. The board has also published its annual tabulation of new laws relating to gas and electric light companies and municipalities owning electric or gas lighting plants.

The Massachusetts Railroad Commission has approved the consolidation of the Union and the Dartmouth & Westport Street Railway Companies, and the increase in the capital stock of the Union Street Railway Company for this purpose by not exceeding 5000 shares, amounting at par value to $500,000. The shares of the two companies are to be exchanged on an even basis, the certificates of the Dartmouth & Westport company to be upon exchange surrendered and canceled.

Among the pending cases before the Massachusetts Gas & Electric Light Commission is the petition of the Selectmen of Plymouth for a reduction in the price of street lights furnished the town by the Plymouth Electric Light Company. At the public hearing in Plymouth on this case the company was represented by its counsel, Mr. Arthur Lord, of Boston, and its general manager, Mr. E. P. Rowell. The petitioners held that the price per kw-hour for street lighting averaged more in Plymouth than in other towns of similar size in the State, and the counsel for the petitioners, Mr. C. S. Davis, argued for a reduction on the ground that the town is not buying light but electrical energy, although it was shown that by the substitution of tungsten lamps for carbon lamps of lower candle-power the town is receiving more light than before for a given expenditure. Mr. Lord pointed out that the price of the company for 40-cp tungsten lamps burned all night is $21 per year each, which he considered reasonable. The old price paid by the town for 25-cp lamps of the carbon type was $20 per year on a 12 o'clock midnight, moonlight schedule. The company's new offer, which is disputed by the Selectmen, thus means a slight increase in the price per lamp-year, but it also means an increase of 60 per cent in candle-power and a 60 per cent longer service than formerly. The town authorities did not seem to appreciate that they are getting a much better quality and a larger volume of illumination under the new plan. The evidence indicated that the company is obtaining a relatively low income per kw-hour for its residential and commercial lighting service. Mr. Lord contended that in the twenty-five years of the company's history it has paid in one year a dividend of 2 per cent and in another a dividend of 1 per cent, so that, measured by the receipts at least, the community has had the use of its capital stock and a substantial part of its bonds with merely nominal return to the investors. Since the fire of April, 1909, the company has rebuilt its plant, and it is now in a better condition than ever to serve the public, but a larger debt presses it down, and the present is an unfortunate time for the town to ask for a reduction in the cost of street lighting.

The company also maintained that it is paying heavy taxes and is facing a demand for certain of its lines to be placed underground, while the cost of maintenance of its lines in the wind-swept territory along the coast which it serves is probably 25 per cent greater than the cost of maintaining inland distribution lines. The street-lighting circuits are carried about fifteen miles along the coast. There are about 350 incandescent lamps involved in the case. The petitioners came to the board for its recommendation as to a proper price upon which to frame a contract. Mr. Lord said that the only fair comparison with the prices in force in other municipalities must take into account the volume and hours of illumination furnished, and that, measured by candle-power hours, the Plymouth service costs the public less rather than more than elsewhere, and the basis of grievance disappears.

AMERICAN ELECTRICAL ENGINEERS.

G. W. Pickard.

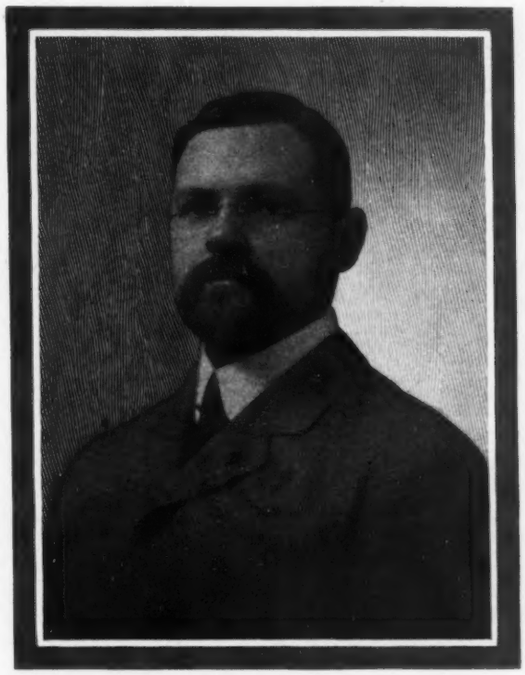
Greenleaf Whittier Pickard was born Feb. 14, 1877 in Portland, Maine, where he attended the public schools, and subsequently his student life was spent at the Westbrook Seminary, Woodfords, Maine; the Lawrence Scientific School, Harvard University, and the Massachusetts Institute of Technology.

Having taken up the study of wireless telegraphy in May, 1899, he was placed in responsible charge, under Dr. A. L. Rotch, at the Blue Hill Observatory, Milton, Mass., for the Smithsonian Institution, of experimenal work in wireless telegraphy, and, in particular, the investigation of very high antennæ. Some account of this work appears in a paper read by Mr. Pickard at the meeting of the Maine Academy of Medicine and Science Nov. 13, 1899, and printed in the *Journal of Medicine and Science* of September, 1900.

In June, 1901, Mr. Pickard became associate engineer of the American Wireless Telephone & Telegraph Company, of Philadelphia, and later chief engineer of the Federal Wireless Telegraph & Telephone Company of the same place. During these engagements he was in full charge of the design of several complete wireless telegraph plants, including stations at Galilee, N. J.; Baltimore and Washington. In July, 1902, he joined the engineering staff of the American Telephone & Telegraph Company at Boston, Mass., in which service he had entire charge of the investigation of wireless telephony. During this period he developed an original system of wireless telephony that was successfully tried in September, 1902. He also had responsible charge of the development of a system and apparatus for the protection of telephone circuits from lightning and high-tension circuits, and a system and apparatus for simultaneous telegraphy and telephony over telegraph wires. Other work consisted of numerous original researches and investigations in

electrical science bearing upon high-frequency oscillations and electrical wave propagation, wireless detectors, telephone relays or repeaters, improvements in telephone receivers and in the measurement of feeble alternating and oscillatory currents. He also acted as chief expert in a number of suits involving wireless telegraph patents.

In June, 1906, Mr. Pickard became consulting and electrical engineer of the Huff Electrostatic Separation Company of Boston, and the Wireless Specialty Apparatus Company, of New York, and also started general practice as a consulting engineer and expert in patent litigation. During this latter period Mr. Pickard has made a number of original investigations, some of which have had a practical development. Among the latter are a simple method of measuring the sensitiveness of wireless detectors; a method of measuring the



G. W. Pickard.

received energy at wireless stations, which for the first time permitted of measurements in absolute units of the received energy in long-distance wireless communication; an investigation of solid rectifiers or asymmetric conductors, and of their adaptation to wireless communication; a method of receiving wireless signals by the use of an underground closed loop of wire, which has permitted the determination of the direction and absolute intensity of the magnetic component of the gliding electrical waves employed in wireless communication, and also enabled important investigations to be made as to the structure of such waves at great distances from their sources. This form of receiving circuit was later applied by Bellini and Tosi in their radio-goniometer, and at present is used in a number of important wireless stations. Accounts of these various methods have appeared in the technical press. Perhaps the most important contribution by Mr. Pickard to the art of wireless communication is the solid rectifier above mentioned. Certain forms of this, notably the "Perikon detector," are now standard in the United States Navy, and it is with this type of detector that practically all the long-distance records of the past two years have been made. To Mr. Pickard have been granted over forty United States and foreign patents, chiefly bearing upon wireless communication. At his home at Amesbury, Mass., he has a wireless station and laboratory entirely devoted to research and development work in wireless communication.

Mr. Pickard is a member of the American Institute of Electrical Engineers, the Society of Chemical Industry, London, and the Wireless Institute, New York, of which latter body he is the vice-president.

CURRENT NEWS AND NOTES.

Tests of Electric Meters.—Of 6293 tests of watt-hour meters made by the Public Service Commission of the Second District of New York in August, 1910, 462, or 7.34 per cent, were fast; 4546, or 72.24 per cent, were accurate, and 1285, or 20.42 per cent, were slow.

N. E. L. A. Membership.—The membership of the National Electric Light Association is approaching the 6000 mark, the membership on Oct. 13 having been 5905, of which 897 are class A or central-station company members. The net gain during the summer months was over 400.

Federal Drift of N. E. L. A. Government.—The recent organization of N. E. L. A. geographical sections in Georgia and Nebraska indicates that before long the government of that body as conducted by the executive committee may pass to the presidents of state and other geographic sections. According to the constitution of that body each president of a geographic section becomes a member of the executive committee, and such members will be in a majority when they exceed in number the fixed number of members who are elected at the annual convention.

N. E. L. A. Committee on Rate Research.—The following committee on rate research has been apointed by the National Electric Light Association: Mr. John F. Gilchrist, Commonwealth Edison Company, chairman, Messrs. R. A. Phillips, of Stone & Webster; A. S. Huey, of H. M. Byllesby & Company; L. H. Conklin, of J. G. White & Company; W. H. Winslow, of Superior Water, Light & Power Company, Superior, Wis.; R. S. Hale, of Boston Edison Company, Boston, and S. E. Doane, of the National Electric Lamp Association, of Cleveland, thus completing the committee of seven.

Electricity in Palestine.—According to United States Consul Thomas R. Wallace, at Jerusalem, nothing more modern than an ordinary oil lamp was used for lighting in Palestine until about four years ago, when the first electric plant was installed. The first building to be thus lighted was the French Convent of Notre Dame de France. The second lighting plant was put up about three years ago in the "Fast" Hotel. The third was in the new German sanatorium opened during the past summer by Prince Eitel. The fourth is now under construction in the Grand New Hotel. These installations consist of a storage battery and generator run by a gasoline engine. All the materials, even to the distilled water, are brought directly from Germany.

Lighting Concession in Russia.—United States Consul-General John H. Snodgrass, of Moscow, has forwarded to the Bureau of Manufactures a comprehensive report in relation to a concession for an electric railway and lighting plant for the Russian City of Peasa. He gives this as an illustration of the numerous opportunities open in Russia for American capitalists and manufacturers. All the cities of any size in that country are introducing modern methods in lighting, sewerage and transportation facilities, and capital is required from foreign countries, from which also most of the supplies necessary for such purposes must be purchased. Pensa has 80,000 population and is the trade center of a populous region. It is the junction of three railways, has thirty-six manufactories, forty-two schools and colleges and is the location of barracks filled with 10,000 soldiers. The concession runs for forty years, includes the payment by the city of a fixed sum of $7,210 per annum, payment for 100 street arc lamps, and many other favorable inducements.

Telephones in Turkey.—It is said that the Turkish Department of Telegraphy intends to install telephone systems in all of the cities of Turkey.

Cleveland Electrical League.—A smoker will be given to the Cleveland Electrical League the evening of Nov. 19 in the Auditorium of the National Electric Lamp Association.

Telegraph and Telephones in Sweden.—According to United States Consul General E. D. Winslow, at Stockholm, Sweden's government-owned telegraph and telephone systems netted the country $192,000 during 1909. The receipts amounted to $458,000, while the cost of operation was $266,000.

Lecture by Mr. Peter Cooper Hewitt.—At a meeting of the Electrical Engineering Society of Columbia University to be held in the Engineering Societies Building, 39 West Thirty-ninth Street, Friday evening, Nov. 4, at 8:15 o'clock, Mr. Peter Cooper Hewitt will deliver a lecture on the mercury-vapor rectifier.

Gas Inquiry in Chicago.—A complete appraisal of all the properties of the People's Gas Light & Coke Company, of Chicago, will be made by experts acting for the City Council committee on gas, oil and electric light. The present rate for gas in Chicago is 85 cents, but the ordinance fixing the price will expire on Feb. 25, 1911, and the committee is endeavoring to determine before that time whether the company can afford to make a lower rate.

California Hydroelectric Development.—The extent to which the available water-power sites in California have been taken up is indicated by a recent investigation in Los Angeles which brought out the information that at every available point of the Tule River, both forks, and on the Kern River clear to the ice limits almost at Kern Lakes, every site has been filed upon by agents of hydroelectric companies. The titles to these sites are owned by either the Edison or the Huntington interests.

Jerusalem to Be Modernized.—It is said that the people of Jerusalem are fast becoming modernized, largely owing to the influx of tourists. David Yellin, who is reported to be a member of the municipality of the Holy City, is quoted in the *Jewish Chronicle* of London as saying that sanitary improvements are proceeding and that European firms have been asked to bid on electric street lighting and street railway installations, as well as a system of water works. These utilities are to be operated by private enterprise, although the municipality reserves the right to take them over after a term of years.

Nitrate Fertilizer in Japan.—A nitrate fertilizer company in Japan has two factories, one at Minamata, where calcium cyanide is made, and the other in Osaka, where sulphite of ammonia is made from the calcium carbide received from the former. The company will soon double its capital and start another factory in north Japan. The calcium carbide sold by the Jananese company always contains 17 per cent or more of nitrogen. An analysis is made at the Minamata factory, and that containing the foregoing percentage remaining unsold is sent to the Osaka factory to be converted into sulphate of ammonia. The wholesale prices of calcium carbide, according to the percentage of nitrogen contained therein, are as follows per ton: 17 per cent, $50; 18 per cent, $52; 19 per cent, $55; 20 per cent, $57.

St. Louis Section of N. E. L. A.—The St. Louis local section of the National Electric Light Association, composed of employees of the Union Electric Light & Power Company of that city, held a meeting at the headquarters of the company on Oct. 28. Mr. John Anderson, of the steam department, read a paper on "Engines." This paper is preliminary to another one which will be read at a later meeting covering the most modern types of engines. Mr. T. C. Hawkins, of the Holophane Company, read a paper on "Distribution of Artificial Illumination." About 150 members were present, and after the technical program had been concluded the entertainment committee amused those present by presenting a number of moving pictures. At the next meeting it is expected that Mr. E. C. Freeze will read a paper on "Conduits and Cables."

Proposed Mississippi Waterway.—On the occasion of a recent visit to St. Louis, members of the government commission of engineers investigating the feasibility of the proposed deep waterway in the Illinois and Mississippi Rivers discussed the proposed dams in the Mississippi at Jefferson Barracks and Commerce, Mo. The former place is about eight miles south of the center of St. Louis and the latter about 140 miles south. By the construction of these dams it is believed that a 14-foot waterway could be maintained between the mouth of the Illinois and the mouth of the Ohio. Each dam would be provided with locks, of course, and the river would be operated, for navigation, like a canal. Incidentally a large water-power would be created for electrical development. The commission is investigating the character of foundations that would be necessary at the proposed dams.

Water-Power Agreement.—The Secretary of Agriculture has recently approved a new agreement allowing the development of water-power within the national forests. Provision is made for the issuance of temporary permits during a period of two years to persons wishing to develop water-power, which will protect such persons during the time necessary for making accurate surveys of the project and for collecting the data on which the final agreement will be based. The general provisions of the permanent agreement contemplate the full development of each water-power site and granting permission to use it for a period of fifty years. Clauses permit a revision of the factors on which the charge for the use of the land is based at the end of every ten years, if the passing of lands into private ownership or changes in the boundaries of the forests require it. A renewal of the agreement may be granted by application to the Secretary of Agriculture not less than two years nor more than four years before the expiration of the old agreement. Some of the leading water-power engineers and attorneys of the United States were consulted in the preparation of the new form of agreement.

Wireless Directory.—In the directory of wireless telegraph stations issued by the Bureau of Steam Engineering of the United States Navy 1520 stations are listed. The number includes shore stations and ships, but does not take into consideration the warships of foreign governments, nor are there listed the hundreds of stations equipped and operated by amateurs, which are the cause of considerable annoyance to the regular stations. There are given first the wireless telegraph shore stations throughout the entire world, according to country, giving call letters, wave length, power, range and character of station. There are about 700 of these shore stations scattered about the globe. Of this number 88 are on the Atlantic and Gulf Coasts of the United States, 3 in the interior, 48 on the Great Lakes, 51 on the Pacific Coast and 16 in Alaska. A separate list shows the 47 shore stations of the United States Navy and another the 344 ships of the navy. The stations of the United States Army are listed separately, showing 30 land stations and 16 stations aboard vessels of that service. In the list of merchant vessels, such as steamships, tugs, yachts, etc., 821 stations are listed. The vessels' call letters and owners, and the apparatus' wave length, power and range in miles are noted. These vessels are scattered over the entire world. As an index, the final list contains the call letters of every station, arranged alphabetically. From this operators can distinguish the name of ship or station calling.

Chicago Convention of the Illuminating Engineering Society.—The Chicago Chamber of Commerce has extended to the Illuminating Engineering Society an invitation to hold its annual convention in that city in 1911.

Denver Club Meeting.—Before 128 members Mr. Wilton Lackaye gave a talk at the weekly lunch of the Colorado Electric Club on Oct. 27. His subject was "Electrical Properties of the Solar System," and was so entertaining that most of the members decided to see "The Battle" during Mr. Lackaye's Denver engagement.

Iron and Steel Electrical Engineers.—The Association of Iron and Steel Electrical Engineers has elected the following officers: President, Mr. L. Palmer, Pittsburgh; first vice-president, Mr. B. R. Shover, Youngstown, Ohio; second vice-president, Mr. C. W. Parkhurst, Johnstown, Pa.; treasurer, Mr. E. W. Yearsley, Philadelphia; secretary, Mr. John Farrington, Steubenville, Ohio.

Everything by Electricity.—Mr. M. Klein, of Denver, is planning a new residence area near the Country Club to have its own heating and artesian water plant, and to purchase electrical energy wholesale from the Denver Gas & Electric Company. It is planned to equip all residences in the district with special electrical circuits, to be utilized for light, cooking, water heating, vacuum cleaning, ventilation, refrigeration and the like. The details are being worked out in conjunction with the engineers of the Denver Gas & Electric Company and of the Rocky Mountain Fire Underwriters' Association.

Union Electric of St. Louis to Remove Its Headquarters.—About Dec. 1 the Union Electric Light & Power Company, of St. Louis, will remove its general offices from the building now occupied at Tenth and St. Charles Streets, which has been outgrown, to the building now under construction at the southwest corner of Twelfth and Locust Streets, which will be known as the "Union Electric Building." Here there will be a handsome display-room in addition to the offices of President Miller and his associates. An interesting feature will be a rest-room, adjoining the Shubert Theater, where patrons of the theater may lounge at their ease and at the same time inspect the most modern electrical appliances.

I. E. S. Banquet.—At the banquet of the Illuminating Engineering Society held at Hotel Belvedere, Baltimore, on Oct. 25, in connection with the annual convention of the society and the inauguration of a lecture course in illuminating engineering at the Johns Hopkins University, a prominent feature was the good-natured rivalry in college enthusiasm among the large number of graduates of the various universities. Combined with the songs and "yells" of the colleges were special references to the individuals who have contributed to the success of the society, the Cornell contingent claiming as its own three of the four past-presidents, with Johns Hopkins laying claim to the fourth past-president and the present president.

Electrical Students at Lewis Institute Night School.—The second ten-week semester of the twelfth year of Lewis Institute (Chicago) night school began Oct. 2, and by the 22d of the month a total of 1712 night students, among whom nearly 500 are taking electrical engineering, had registered. The three-year course is given in three semesters of ten weeks each in each year, students attending two or three nights each week. Besides the 507 engineering students, 365 are taking drawing and shop work, 169 mathematics and 57 chemistry. The majority of the students are of mature age and exhibit determination in their school work; and in the advanced classes many technical and college graduates are found. The night-school work is in charge of Prof. P. B. Woodworth, of the department of electrical engineering.

Meetings of the New York Electrical Society.—The New York Electrical Society has arranged for a visiting meeting to Llewellyn Park, on a date not yet set, to inspect the laboratory of Mr. Thomas A. Edison and see the Edison storage battery in process of construction. Among the lectures announced for this season, which represents the fortieth year of its existence, are the following: *The Effect of the Telephone on Modern Industrial and Social Life,* by Mr. Herbert N. Casson; *The Catskill Water Supply,* by Hon. Chas. N. Chadwick; *Electricity and the Panama Canal,* by Mr. David B. Rushmore; *Hydroelectric Development in Mexico,* by Mr. F. O. Blackwell; *The Rapid Transit Problem of New York City,* by Mr. H. St. Clair Putnam; *Wave Motion by Electricity and Other Energy,* by Dr. C. P. Steinmetz; *The Physics of Light Sources,* by Dr. E. P. Hyde; *The Relation of the Modern Incandescent Lamp to the Central Station,* by Mr. S. E. Doane.

Waterway and Water Power Agitation in Illinois.—At a political meeting in Jacksonville, Ill., on Oct. 22 Gov. Deneen placed himself on record as in favor of the immediate purchase by the State of Illinois of the available water-power sites along the route of the proposed deep waterway to be made by deepening the Des Plaines River from Lockport, Ill., to its junction with the Kankakee River to form the Illinois River, and from that point in the Illinois River to Utica, Ill. The purchase price, according to the Governor's program, is to come from the sale of bonds out of the $20,000,000 issue already approved by the people of the State. The estimated cost at the present time of the purchase of five water-power sites between Lockport and Utica is figured by the Governor's engineering advisers as something over $350,000. The Governor asserted that private interests are endeavoring to secure these water-power sites, and that the State should act promptly to obtain control.

St. Louis League of Electrical Interests.—The League of Electrical Interests of St. Louis gave a smoker on Oct. 21 at the assembly hall of the United Railways Company, on the corner of Grand and Vista Avenues. This hall is an ideal place for entertainments, being approximately 125 ft. square and having a stage, dressing-rooms, etc. It was attractively decorated with flags and bunting, and over the entrance was an electric sign, "L. of E. I.," flashed in white and red lamps. There were 150 members present, and the United Railways Company's band of fifty pieces gave a number of selections, one being the "Anvil Chorus" with spectacular electrical effects. Mr. Charles W. Brainerd, a tenor singer, pleased the audience greatly by his rendition of several songs. There were cigars, pipes and tobacco for all, and after the musical program there were a number of impromptu speeches and stories. This was followed by a buffet luncheon. The occasion was greatly enjoyed by all present, and the league has plans for several other meetings of this kind during the coming winter.

Removal of Elevated Railway Pillars for Chicago Through Street Railway Routes.—After negotiations lasting for some time the surface street-railway companies and the Northwestern Elevated Railroad Company, of Chicago, the latter owning the Union Loop, have reached an agreement, after the intervention of Mayor Busse, in relation to the removal of certain pillars supporting the elevated structure. It is desired to remove about twenty of these supports in order to permit the laying of surface tracks with suitable curves to provide for the through routes and large cars contemplated by the street-railway rehabilitation ordinances. The work will be done by the Northwestern Elevated Railroad Company, and the cost will be borne by the Chicago City Railway Company and the Chicago Railways Company, which operate the surface lines. It is estimated that the cost of removing each pillar and substituting other supports will be about $10,000, making the total expense about $200,000. The work will be done under the supervision of the Board of Supervising Engineers, Chicago Traction.

Nine-Year-Old Electric Truck.—Among the entries for the New York commercial truck run, Oct. 28 and 29, is that of a nine-year old electric truck by the Central Brewing Company, of New York. The owners state that the working record of the truck is 2600 days, with relatively small cost for repairs.

Lessons from Electrical Accidents.—In the article entitled "Lessons from Electrical Accidents," appearing on pages 797 and 798 of the issue of Oct. 6, credit for the information contained should have been accorded to Mr. Michael Longridge, chief engineer of the British Boiler & Electrical Insurance Company, Manchester, England.

Fuel from Peat.—A peat fuel plant is projected for Winnipeg (Manitoba) having a capacity of 100,000 tons per annum. Mr. L. B. Lincoln, manager of the Canada Fertilizer Company, of Montreal, has been in Winnipeg for the purpose of investigating, surveying and examining the peat deposits in that vicinity with a view to the proposed location of a plant there. The plant, if erected, will most likely be of the same type as the company has outside of Montreal, where the peat is automatically excavated from the bog, then run through a mecerating machine and finally delivered on top of the bog in the shape of pulp.

Iowa Electrical Association Convention.—During the recent Illinois State Electric Association convention at Rock Island several members of the executive committee of the Iowa State Electrical Association met and decided upon the dates and preliminary arrangements for the next convention of the Iowa Electrical Association. This is to be held at Davenport April 19, 20 and 21, 1911. Arrangements have been made for the use of the Davenport Coliseum, which has a large floor space, 90 ft. x 120 ft., free from obstructing columns, which will be used for exhibits. A sound-proof room elsewhere in the Coliseum will be available for the convention sessions. Mr. W. N. Keiser, of the Union Electric Company, Dubuque, Iowa, is secretary.

Newspaper Technics.—The battery-charging installation used by the Pennsylvania Railroad at Altoona in connection with its passenger car lighting service was described recently in one of the daily papers as follows: "The current has been transformed from alternating to direct before being stored in the batteries, and as a matter of economy in time and expense a mercury system is now used with success, and has been for several months. The transformer is a large glass case, over which glows an arc through which the current passes. It then goes through the transformer, which is filled with mercury, the metal taking up one pole of the electricity, and it comes out on the feeding wires as direct current. It is then fed to the storage batteries of the cars, which in a few hours are ready for the road."

Philadelphia N. E. L. A. Meeting.—The first meeting of the season of the Philadelphia Electric Company Section of the National Electric Light Association was held on Monday evening, Oct. 17, 1910, in the assembly room of the main office of the Philadelphia Electric Company, with 114 members and guests in attendance. Mr. Joseph D. Israel, section chairman, opened the meeting with an address in which he outlined all the work which it is hoped to accomplish during the ensuing season, particular mention being made of the work of the membership committee, which, it is hoped, will double the membership this season. Strenuous efforts are being made to encourage all company employees to become members of the association, and judging from the results thus far the prospect is very bright. The chairman then introduced the speaker of the evening, Mr. John Meyer, who presented a paper on "Commercial Engineering," the subject embracing every department of the company. After a brief review of the many trials of the solicitor in securing large contracts, particularly motor installations, in which all the arguments used were presented, and also the probable questions of the prospective consumer, a few concrete cases were cited in which the actual figures, showing the estimated income and the results obtained, were given; also the effect of these new installations on the station load curve. The lecture was illustrated with numerous lantern slides.

Telautographs for Automatic Telephone System.—A telautograph system will be used for transmitting and recording trouble reports from the trouble desk at the central office to the maintenance men at the various substations of the new automatic telephone system now being installed for the Illinois Tunnel Company in Chicago. Subscribers will be instructed to call a certain telephone number in case of trouble, and the clerk receiving these calls will be provided with a telautograph transmitter communicating with a receiver at each of the six automatic substations where the switching apparatus is installed. In this way the trouble reports will be received and transmitted promptly and a record left at both the central office and substation, largely eliminating the human element, which is the aim of the automatic apparatus.

Boston 1912 Electrical Exposition.—The Edison Electric Illuminating Company of Boston has leased the entire Mechanics Building, on Huntington Avenue, Boston, for the holding of a large electrical exposition during the month of October, 1912. The company plans to make the exposition the largest ever held by a central station, and has arranged for the installation of exhibits during the entire month of September, 1912, and has also provided for ample time following the conclusion of the show in October for the removal of the displays. Mr. L. D. Gibbs, superintendent of advertising, has begun to catalog for reference purposes descriptions of every appliance that uses or in any way promotes the use of electricity, together with the names of manufacturers, the points where such apparatus can be obtained, the retail price and power consumption. The company is desirous of obtaining descriptive matter covering the foregoing points, addressed to its main offices at 39 Boylston Street, Boston, in the care of the advertising department.

The A. I. E. E. Edison Medal.—The Edison Medal Association, formed by the friends and admirers of Mr. T. A. Edison to found a gold medal in the American Institute of Electrical Engineers celebrating the invention of the incandescent lamp and twenty-five years of its successful use, has just closed up its accounts. The association began its work five years ago and raised a fund of somewhat over $7,600 for the purpose. Of this account $5,000 was placed in the hands of the institute for the medal award fund. The contract for the design of the medal was made with Mr. James Earle Frazer, the well-known sculptor, who, owing to the change in the deed of gift, was called upon to make two separate designs and who received about $1,500 for his work. The medal was at first to be awarded to the best thesis submitted by students of electrical engineering, but this plan proved a failure and only one award was made to a student competing, the amount being $150 without a medal, but with a special certificate. A new deed of gift was then drawn up by which the medal is awarded for meritorious achievement in electricity, and this year Prof. Elihu Thomson was the first recipient. The other principal sums from the fund were $544 for the reduction of the medal design, for the steel dies and for a small number of bronze replicas presented to institutes and to those interested in the work. A further amount of $207 was paid for the design and reproduction of the certificate accompanying the medal, and the remainder of the fund was used up in stationery, postage and petty cash expenditures. The $5,000 fund since it was placed in the hands of the institute has grown considerably. The officers of the Edison Medal Association engaging in carrying out this work on behalf of the subscribers and representing them with the institute and with the institute Edison Medal Committee have been: Mr. Samuel Insull, president of the association; Mr. Frank S. Hastings, treasurer, and Mr. T. C. Martin, secretary, by whom the accounts have been balanced and verified.

INTERCONNECTED MASSACHUSETTS GENERATING PLANTS.

System and Operating Features of the Greenfield Electric Light & Power Company.

A SUGGESTIVE example of the co-ordination of water-power and steam-power in central-station service is afforded by the system of the Greenfield Electric Light & Power Company, of Greenfield, Mass. Although the communities supplied with energy by the company are of moderate

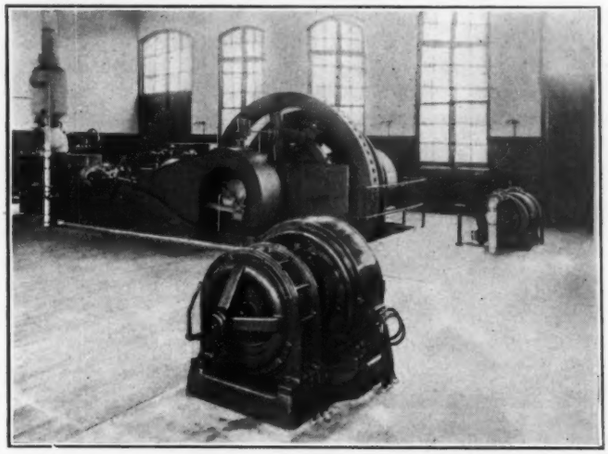


Fig. 1—500-kw Engine-Driven Generator and Exciters.

population, the area of the territory served and the location of generating and distributing installations combine to form an engineering situation of considerable interest. The demands upon the company embrace the supply of electricity for traction purposes in addition to the usual lighting and motor service in residential and industrial fields. The sphere of influence of the company is of more than local extent, and the combination of a progressive commercial policy with a skilful technical administration has established the business upon a thoroughly satisfactory basis.

The company now serves the towns of Greenfield, Shelburne Falls, Old Deerfield, including East Deerfield and Buckland; the total population of its territory being about 15,000 persons. Within the past year the company has purchased the plant and business of the Shelburne Falls Electric Light & Power Company, and it is now engaged in co-ordinating the equipment into a single effective generating and distributing system. Greenfield and Shelburne Falls are prosperous manufacturing communities, and the company is keenly alive to the advantages of establishing an electric power load in all parts of its

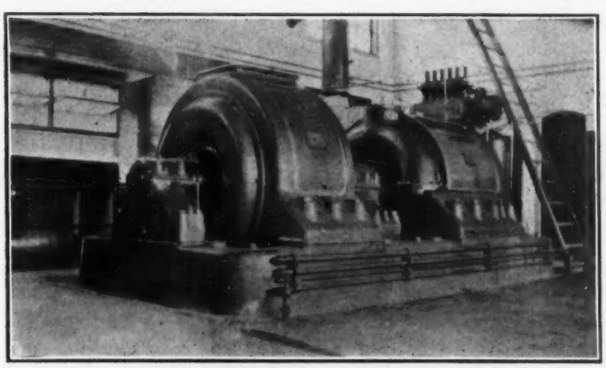


Fig. 2—Horizontal Turbo-Alternator.

territory. Motors are in operation in machine, carpenter, woodworking, pocketbook, underwear, cutlery, box, pattern and tool shops, in stone-crushing plants, laundries, brick yards, grinding plants, pumping and many other industries which have an integrated energy consumption of beneficial effect upon the load factor of the generating equipment, and which provide about one-half the company's total annual income.

The operating headquarters of the system are at Greenfield, where the company maintains an auxiliary steam plant and a transformer substation for local distribution in the lighting, industrial and railway fields. From the Greenfield station three 10,000-volt transmission lines are run respectively to Turners Falls, Shelburne Falls and Hadley. The generating capacity of the auxiliary steam plant at Greenfield is about 2000 kw. At Turners Falls the company utilizes generators rated at a total of 1000 kw, and at Shelburne Falls an 800-kw installation is available. The power derived from Turners Falls and Shelburne Falls is hydroelectric, and the company utilizes this as far as possible without running its steam plant at Greenfield.

The three-phase transmission lines between Greenfield and the above points are independent of one another. The Shelburne Falls line is eight miles in length and is of No. 1 copper. The Turners Falls line is of No. 3 copper, and is 3.5 miles long. The line to Hadley is 19.5 miles long, and is a No. 4 copper circuit, being used exclusively for the supply of energy to a 480-kw motor-generator substation of the Connecticut Valley Street Railway Company. Electric railway distribution in the Greenfield district is from a rotary converter substation established in the Greenfield generating station. A storage-battery installation is also in service at Greenfield for the purpose of regulating the supply of energy to the railway. The total generating capacity of the company is approximately 4000 kw, including water-driven and steam-driven machinery.

On account of recent improvements in its equipment and arrangement the auxiliary steam plant at Greenfield is in con-

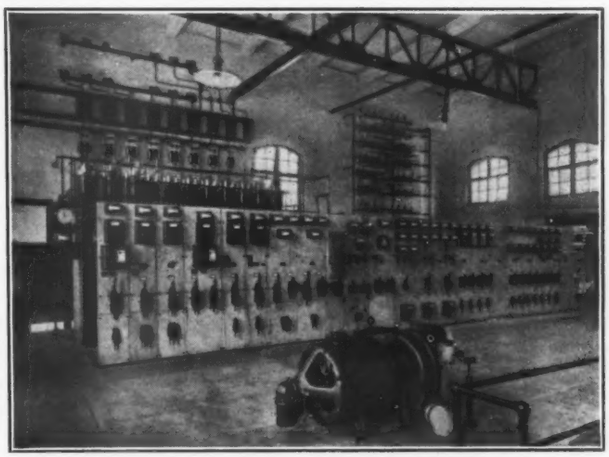


Fig. 3—High and Low-Tension Switchboard.

dition to meet any anticipated emergency demands upon the system. This station now contains two direct-connected and two belted generating units, and a modernized boiler plant with an economical coal-handling installation. The coal supply is received by rail, the plant being located below the Fitchburg division tracks of the Boston & Maine Railroad near the center of the town. Formerly all the fuel was carted to the station at a cost of about 40 cents per ton. By the installation of a coal trestle about 200 ft. long and a conveyor equipment driven by a 7.5-hp, 220-volt induction motor the fuel is now delivered at the boiler-room door at a cost of less than 5 cents per ton. The company burned last year about 760 tons of bituminous coal, the average cost of fuel being about $4.68. The supply of water at the hydroelectric plants is sufficient to enable the Greenfield steam-generating machinery to be shut down about eight months per year.

The steam-generating equipment at Greenfield consists of one 600-hp Stirling and three 250-hp Hazleton boilers, hand-fired. The present boiler house was erected during the past summer on the site of the old installation, the latter having reached a stage of dilapidation. A run of high water per-

mitted the changes to be made with minimum difficulty from the generating point of view. The new boiler house is built of brick, and is of heavy mill construction, with a concrete roof. Space has been left for the installation of two additional 400-hp boiler units, and one of these will probably be installed before next spring. During the period of reconstruction one boiler was kept in readiness for service at all times. When the boilers were relocated they were equipped with smokeless furnaces and a system of fixed pipes and nozzles for soot blowing. The emission of black smoke has been almost entirely eliminated. Each boiler is provided with an individual stack, that on the Stirling unit being 133 ft. high and 5 ft. in diameter, and the other three are each 62 ft. high and 3 ft. 6 in. in diameter. Steam is delivered to the prime movers at 130 lb. pressure, condensing water being supplied from a small pond located at the sides of the station and having a capacity of about 1,500,000 gal.

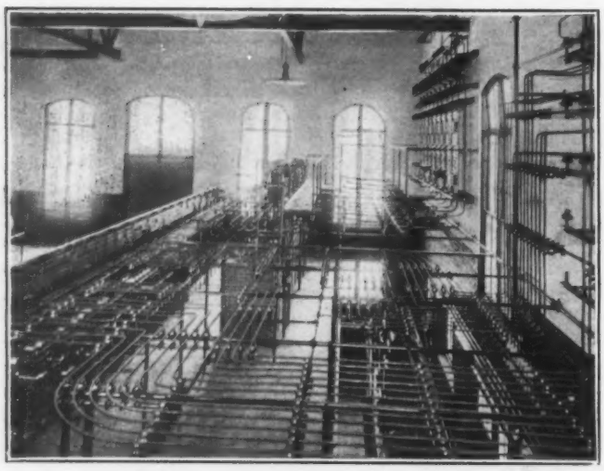


Fig. 4—Rear of Switchboard, Showing Outgoing and Incoming Lines.

The station now contains a 500-kw, three-phase General Electric alternator of the revolving field type, wound for 2300 volts, and direct-driven by an 18-in x 36-in. x 36-in. horizontal cross-compound McIntosh & Seymour engine; a 937-kva horizontal Curtis turbo-alternator wound for 2300 volts, and two 400-kw alternators, belt-driven, in an older section of the station, by Harris and Russell engines. One of the 400-kw machines is run as a synchronous motor a large part of the time for its effect on the station power-factor. The latter can be raised from 60 per cent to practically unity by the absorption of about 35 kw in the synchronous condenser. All the engines in the plant are of the condensing type, and the turbine is equipped with an Alberger jet condenser.

The energy supply from Shelburne Falls is furnished by two 400-kw, 10,000-volt, waterwheel-driven generators, running upon a head of 37 ft. provided by the Deerfield River. The old Shelburne Falls company operated a 90-kw installation within that town, an 1100-volt service being supplied. This old station will give way to the modernized service from the Greenfield company's system as soon as possible. At Turners Falls the water supply is controlled by the Turners Falls Power Company, which there utilizes the flow of the Connecticut River for hydroelectric transmission to Greenfield, Northampton, Easthampton and Amherst.

The 10,000-volt service received from the hydroelectric plants is stepped down at Greenfield to 2300 volts by two banks of transformers, one bank consisting of three single-phase, oil-cooled units of 250-kw rating, and the other of three 300-kw, air-blast, single-phase outfits, all the service being delivered and utilized at a frequency of 60 cycles. The air-blast transformers are cooled by two blower sets, each consisting of a 2-hp, 220-volt, three-phase fan motor, either being capable of supplying air to three transformers. A convenience for charging the sparking batteries of automobiles has been provided by belting a 12-volt, 30-amp, direct-current generator to one of the blower motors. The cost of operating this charging generator under such circumstances is practically nil.

The station wiring is arranged so that the Turners Falls and Shelburne Falls lines can be operated in multiple if desired or run on separate sections of the 10,000-volt station buses. Energy is supplied to the Hadley substation line without potential transformation or phase-alteration. Tirrill regulators are installed in each station, and at the Turners Falls end of the line a three-phase, 2300-volt induction regulator is installed, the range being 10 per cent up or down, and this regulator automatically compensates for line drop and maintains the potential at the receiving end of the line within 2 per cent of normal. The 2300-volt busbars in the Greenfield station are divided into two sections, and either alternator or set of step-down transformers can be run on either bus section. Double-throw oil switches provide for these changes as needed.

The 2300-volt outgoing feeder lines at Greenfield are carried on insulators supported on wrought-iron pipe framework behind the switchboard, which is of the usual type, with twenty-four panels installed on the engine-room floor facing the generating units. The outgoing feeders are carried through the station wall from insulators supported on angle-iron horizontals, the feeder lightning arresters being mounted on the walls just below where the lines leave the building. The 10,000-volt incoming lines are equipped with lightning arresters on the opposite end of the wall behind the switchboard, and the regularity of the wiring and freedom of access available are unusual. From the lightning arresters the 10,000-volt lines are carried to oil switch cells behind the panels through appropriate conduit and potheads. The transformer installation is located in the basement directly below the switching area. In the station are installed five automatic motor-driven General Electric feeder regulators for controlling the lighting-circuit potential. The range is 10 per cent above and below normal, and these regulators maintain the voltage at a selected point on the distribution system within 2 per cent of normal. Each lighting circuit is provided with a compensated voltmeter connection and Bristol recorders are used to follow the potential which is maintained on the distribution system. Charts from these are taken daily and after examination by the superintendent are filed at the station. These regulators are all installed at the rear of the switchboard near the oil switch cells. When the steam plant is shut down the regulators at the hydroelectric stations maintain the desired steadiness of voltage at Greenfield.

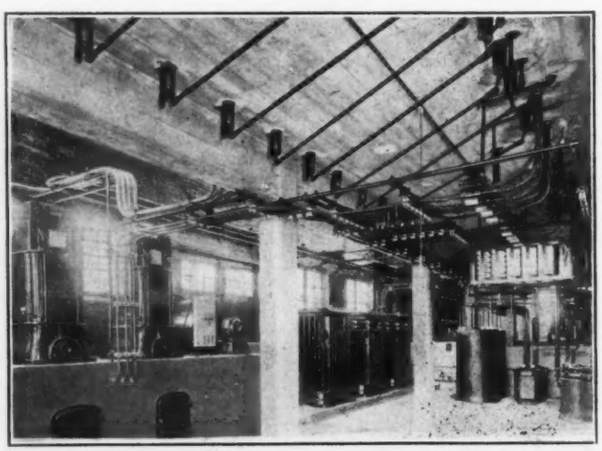


Fig. 5—Transformers, Rectifiers and Regulators.

In addition to the railway supply the station at Greenfield delivers for service 2300-volt, single-phase and three-phase current for general lighting and industrial uses. Each circuit is equipped with an indicating wattmeter and a watt-hour meter. The local street lighting requires eighty magnetite arc lamps of the 4-amp size, these being the first installed in Massachu-

setts. There are also about 100 60-cp tungstens in service. Direct current for the use of the magnetite arcs is obtained by the installation of mercury rectifiers in circuit with constant-current transformers.

An unusual feature of the Greenfield service is the use of a storage-battery and booster equipment to control the effects of railway load fluctuations on the alternating-current side of the system, in order to enable the lighting company to handle this service more efficiently and economically. The battery is housed in a small wooden building outside the main station, and 288

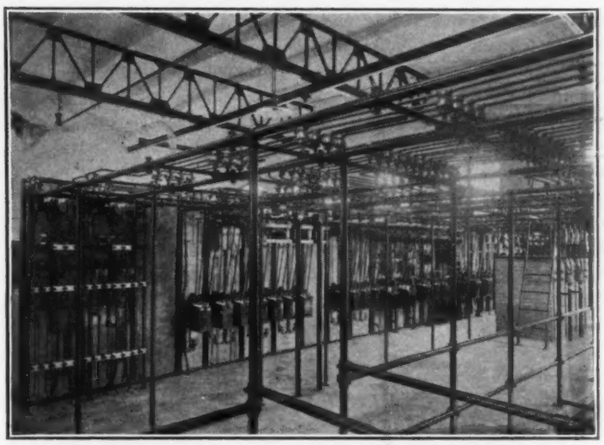


Fig. 6—Oil Switches and Feeder-Wire Framework.

cells are provided, the Electric Storage Battery Company, of Philadelphia, having supplied the installation, including a carbon regulator. The battery is connected across the direct-current busbars of the railway system, and is controlled by the regulating apparatus, which in turn is operated through a series transformer placed in the railway alternating-current line. In case a momentary demand for energy in large quantity falls upon the Hadley substation, it is supplied by the battery in the following manner: the effective voltage of the battery is increased automatically by the regulating apparatus until the rotary installation at Greenfield inverts, and thus furnishes the Hadley transmission line with an extra volume of alternating current, instead of allowing the whole demand to fall upon a water-power plant of the railway company located at Millers Falls. Under these conditions the local direct-current load at Greenfield for railway service is supplied by the battery. The inversion of the rotary at Greenfield, however, is relatively infrequent, because ordinarily the taking up of a portion of the direct-current load at Greenfield by the storage battery is sufficient to compensate for the increase in the load at the Hadley substation. In case the load at Hadley falls off the battery helps to maintain a normal demand on the power station by absorbing a charge equal to the falling off in load. The carbon regulator controls the field coils of a small motor-generator set which in turn excites the field coils of the booster. The booster consists of a direct-current machine driven by an induction motor, and is so connected that it receives through its armature all the current which passes in or out of the storage battery.

The normal method of operating the station is to parallel the two 10,000-volt lines at the Greenfield bus, and when occasion demands to run one or more steam-plant units in parallel with either or both the 10,000-volt lines. The average load on the station for a twelve-hour day, including the railway, is from 1100 kw to 1200 kw, and for a twenty-four-hour day it is from 700 kw to 800 kw. The commercial motor load averages about 700 kw. The momentary peaks on the combined loads are normally from 1500 kw to 1600 kw, with an occasional rise to 1800 kw in case of a sudden storm or rush of holiday traffic. The total losses on all the lines amount to between 10 per cent and 15 per cent. The company has expended considerable money in providing the 2300-volt feeder lines throughout the town with lightning arresters, and the results have been very satisfactory. All the company's power plants operate on eight-hour shifts. The railway load averages from 500 kw to 750 kw normally.

The company's connected load on June 30, 1910, was:

GREENFIELD AND DEERFIELD.	
Municipal arcs, 71 320-watt magnetites	22.72 kw
Commercial arcs	15.01 "
Municipal incandescents	6.69 "
Commercial incandescents, carbon lamps	758.40 "
Commercial incandescents, tungstens	310.48 "
Total connected lighting load	1113.30 kw
Motor load, connected, commercial motors (336)	1312.59 "
Motor load, street railway apparatus	980.00 "
Total connected load	3405.89 kw

The company's total output at the switchboard for the year ended June 30, 1910, was 5,242,224 kw-hours. The company sold for street lighting during the year 141,448 kw-hours; for lighting by meter service, 311,781 kw-hours; for contract lighting, 15,592 kw-hours, estimated; for industrial motors, 962,862 kw-hours, and to street railway consumers, 2,811,630 kw-hours. The company used 39,790 kw-hours in its auxiliary and own lighting service, and the total energy accounted for amounted to 4,283,103 kw-hours, leaving 959,121 kw-hours unaccounted for. The maximum station load during that period was 1400 kw, occurring Dec. 13, 1909, at 6 p. m., and the maximum load on the day of least output was 590 kw, the date being May 8, 1910, at 8 p. m. The energy sold to the Connecticut Valley Street Railway Company was measured and delivered at the Greenfield station. From the Turners Falls company the Greenfield company purchased 1,795,145 kw-hours, at a cost of $8,975.73, measured at the hydroelectric station. The Greenfield company bears in addition the line losses and the annual charges upon the transmission system, including maintenance.

The company's return to the State shows that its total income for the year was $111,893.75, the larger items being: Sale of energy to railways, $39,385.08; energy for industrial purposes, $23,994.17; commercial arc and incandescent lighting, $38,373.06,

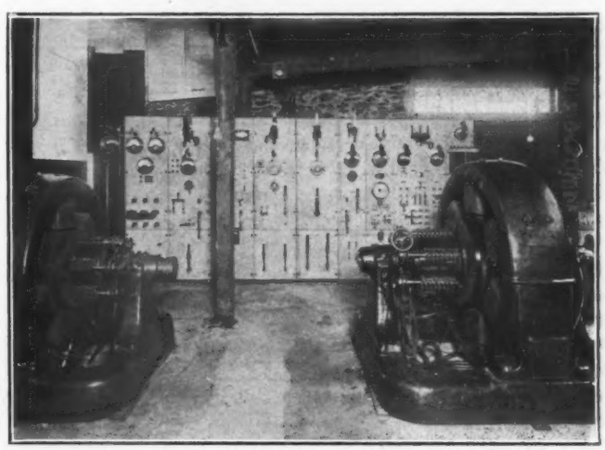


Fig. 7—Railway Switchboard and Rotary Converters.

including service charges. The operating expenses for the year were:

Manufacturing cost at station (fixed charges omitted)	$18,083.10
Purchased electricity @ 0.5 cent per kw-hour	8,975.73
Distribution expenses	18,704.76
Office expenses and management	8,461.25
Taxes	5,352.27
Insurance, legal claims, etc	1,132.48
Total expenses	$60,709.59

The company declared dividends of 6 per cent on its capital, the amount disbursed being $19,500. An allowance of $18,000 was made for depreciation, $6,536.65 being assigned to the steam plant and $11,436.35 to the electric plant. The total investment in the physical plant on June 30 last was $463,083.22, or about $163 per kilowatt of generating capacity owned by the company June 30, 1910, the latter being then 2850 kw. The

larger items were: Water-power plant, $154,463; steam plant, $83,382; overhead lines, $79,950, and electric plant, $60,111.

The company's 10,000-volt lines are carried on 35-ft. chestnut poles. Its distribution system includes 1,195,444 ft. of wire, subdivided as follows: Municipal arcs, 133,800 ft.; municipal incandescents, 22,645 ft.; commercial primaries, 226,732 ft.; commercial secondaries, 226,215 ft.; transmission lines, 325,659 ft.; power primaries, 235,510 ft.; power secondaries, 24,882 ft. There are 2467 poles in service. The transformer equipment on the distribution system includes 286 outfits, the most common size being 1 kw. The number of meters now in use is 1119. The street-lighting service averaged 3898 hours burning last year, and the company used 1446 electrodes. The rate for street-lighting service is $78 per arc lamp per year, and for 60-cp lamps at Greenfield, $24 per lamp-year.

The company's prices for electric energy for lamp circuits vary from 15 cents to 8 cents per kw-hour, according to the consumption, with a discount of 10 per cent for a ten-day cash payment on all bills in excess of $1.65 per month. For amounts under 75 kw-hours per month the rate is 15 cents, and over 600 kw-hours, 8 cents. For motor circuits the rates range from 6 cents per kw-hour, with a monthly total of less than 100 kw-hours, to 1.8 cents for over 10,000 kw-hours per month. The minimum monthly bill on the motor service is $1.50 up

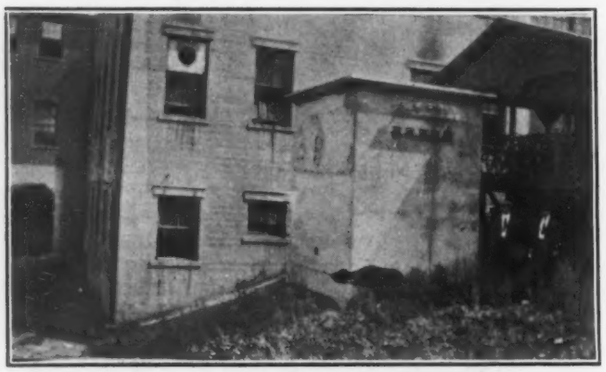


Fig. 8—Factory Transformer House.

to and including 3 hp, and on installations of more than 3 hp the minimum is 50 cents per horse-power connected per month. Electric sign and window lighting are handled on the following flat-rate basis: 60-watt tungsten lamp, 60 cents per lamp per month; 100-watt tungsten lamp, 90 cents per lamp per month; 5-watt, 11-volt sign lamp, tungsten, 7 cents to 7.5 cents per lamp per month. These lamps are extinguished at 10:30 p. m., and are not burned on Sundays. The company reduced its prices for arc-lamp service from $87.50 to $78 during the year, and the rate on public incandescents was changed from $29 for 40-cp units to $24 for 60-cp lamps. Carbon and graphitized filament lamps are renewed free by the company, the customer paying for initial and renewal installations of tungstens.

The company maintains an attractive office and display room on Federal Street, Greenfield, and has been successful in introducing appliances of diverse types. Occasionally some current-consuming article is placed in the window and a card attached stating that the price will be reduced daily until the device is sold. Popular interest is keen in this policy. Electric signs are purchased by customers and installed free by the company. The company wires buildings at cost, and practically all the mercantile windows in town are equipped with tungsten lamp advertising. Besides supplying energy for lamps and motors the company has over 300 electric flatirons on its lines, as well as glue-pots, water-heaters and cooking apparatus, including one 40-gal. water-heating tank and a 20-kw drying oven for drying japan on metal work. An electric oil-tempering bath, consuming 3000 watts, is in service at the regular motor rate. Two houses are completely equipped for electric cooking. The company's earnings have been nearly doubled in the past three years, and close personal relations are maintained with customers in order to keep the service at the highest possible standard. The company has constantly striven to give good regulation on its lines, and has expended money liberally to this end, so that the results are excellent in spite of the variations in the load and its diverse character.

In connection with the purchase of the Shelburne Falls property the company is planning to reconstruct the entire distributing system in the towns of Shelburne Falls and Buckland, spending about $46,000 on improvements. The Shelburne Falls company was owned by the partnership of Messrs E. J. Halligan and C. H. Wilcox, and the Greenfield company acquired the system on Sept. 1. The Shelburne Falls company earned about $7,300 a year, and had ninety-five customers in Shelburne Falls and twenty-five in Buckland. When taking over the property the Greenfield company issued a statement to the people of the Shelburne Falls district pointing out that the new management would supply twenty-four-hour service and the Greenfield rates were to apply throughout the entire district. An illuminating engineer has been sent into the territory by the company to facilitate modernized house and store lighting, and special efforts are being made to secure residence customers. Out of 1941 residences in the town of Greenfield there are approximately 675 wired and using electricity. A display room will be opened in Shelburne Falls in the near future for the special sale of appliances.

DATA OF PLANT OPERATION, GREENFIELD, 1910

Kw-hours delivered at busbars	5,242,224
" sold, total	4,101,865
Percentage of output sold	78.3
Kw-hours sold, electric railway service	2,811,630
" " industrial motor service	962,862
" " commercial lighting	327,373
" " municipal lighting	141,448
Total income	$111,893.75
Earnings from electric railway energy sales	$39,385.08
" " industrial energy sales	$23,994.17
" " commercial lighting	$38,373.06
" " street lighting	$8,824.26
Total cost of physical plant	$463,083.22
Cost of overhead lines	$79,949.78
" " transformers	$19,620.05
" " meters	$16,077.03
Kw rating of generating equipments, June 30	2,850
Operating expenses (incl. legal, taxes, mfg., distribution)	$60,709.59
Connected load in kw	3,406
Total number of residences	1,941
Number of residences wired	675
Average total earnings per kw-hour sold, cents	2.72
Average earnings per kw-hour sales for motor uses, cents	1.68
" " " " " to electric railway, cents	1.4
" " " " " for industrial motors, cents	2.5
" " " " " for commercial lighting, cents	11.7
" " " " " for street lighting, cents	6.3
Total cost of plant per kw of station generating capacity	$163.00
Average income per kw of industrial motor load connected per year	$18.20
Population served (census of 1905)	11,268
Total liabilities per kw station capacity	$176.00
Gross yearly income per kw station capacity	$39.20
Per cent of gross yearly income expended for operation	64.5
Yearly operating expenses per $100 liabilities	$12.10
Average income per consumer (897 customers)	$124.50
Total connected load in kw per kw station capacity	1.2
" " " all motors (kw) per kw station capacity	0.46
Kw-hours sold per 100 kw-hours generated and delivered at bus	78.5
Yearly load factor (average load divided by maximum), per cent	42.8
Gross yearly income per capita	$9.90
Investment per capita	$41.30
Watts station capacity per capita	253.00
Number consumers per 100 of population	8.00

A noteworthy feature of the company's motor service is the installation of concrete transformer houses. A typical house is located on the premises of the Goodell-Pratt Company, a prominent maker of mechanics' tools. This establishment has thirty-three motors in service, and the transformers for the service are placed in a 10-ft. x 10-ft. x 14-ft. house, with 7-in. walls and good drainage, the cost of the house being about $200. Pipe framing 1¼ in. in diameter is used to support the interior oil switch equipment, and there are one 15-kw and three 30-kw transformers in the building. This arrangement adds much to the safety and convenience of the service, as fuses can be replaced with little loss of time, and the locking of the building and use of iron conduit in the factory, with a separate concrete meter and switch room for departmental subdivision of energy costs, leave no room for the usual possibilities of interference and accident. The foundry of the foregoing establishment is one of the most complete in Central New England, and all the tools are driven by direct-connected

motors, including a stack blower, heating fan, core sand mixer, mills, dust exhausters and grinders. The foundry proper is effectively lighted by a single 500-watt regenerative flame-arc lamp, the dimensions of the pouring room being 120 ft. x 40 ft., with the lamp 35 ft. above the floor.

A summary of recent data bearing upon the company's operations is given in the table on the preeding page.

The officers of the company are: President, Mr. Joseph W. Stevens; clerk, Mr. Charles H. Keith; treasurer and superintendent, Mr. George W. Lawrence, all of Greenfield. The directors are: Messrs. Joseph W. Stevens, Charles C. Dyer, Frank O. Wells and William B. Allen, Greenfield; and Philip Cabot, Boston; Winthrop Coffin, Brookline, and John J. Mackintosh, Holyoke, Mass.

LOW-HEAD WATER POWER AT MANHATTAN, KAN

On July 8 last the Rocky Ford Milling & Power Company started up its 800-kw hydroelectric generating station, utilizing a 13-ft. fall in the Blue River, in north-central Kansas, and transmitting electrical energy into the City of Manhattan, three miles distant. At the Rocky Ford, where the new plant is located, a government gaging station has demonstrated that the stream flow during a number of years has never diminished beyond a minimum of 535 cu. ft. per second. For forty-three years an old four-story stone mill structure occupied this site, and when demolished to make way for the present development furnished a large part of the material which went into the new power house. The station building is of concrete, and has a floor area of 21 ft. x 54 ft.

The former wooden dam has been replaced by one of concrete, extending 283 ft. across the stream and having an arch of 15 ft. upstream. The dam is 14 ft. 4 in. high, and is carried on a 14-ft. base seated on bed-rock. The stratum runs thin just below the dam, however, and to guard against wear of this rock by the discharged water, a buffer footing 3½ ft. thick has been added to break the falling force of the spill. Along the crest of the dam, at 5-ft. intervals, vertical pieces of 2-in. pipe, 15 in. in length, have been cast flush with the concrete. By inserting suitable flash-board standards in the dockets formed by these pipes, a simple and effective method is provided for supporting boards used to raise the effective level of the dam.

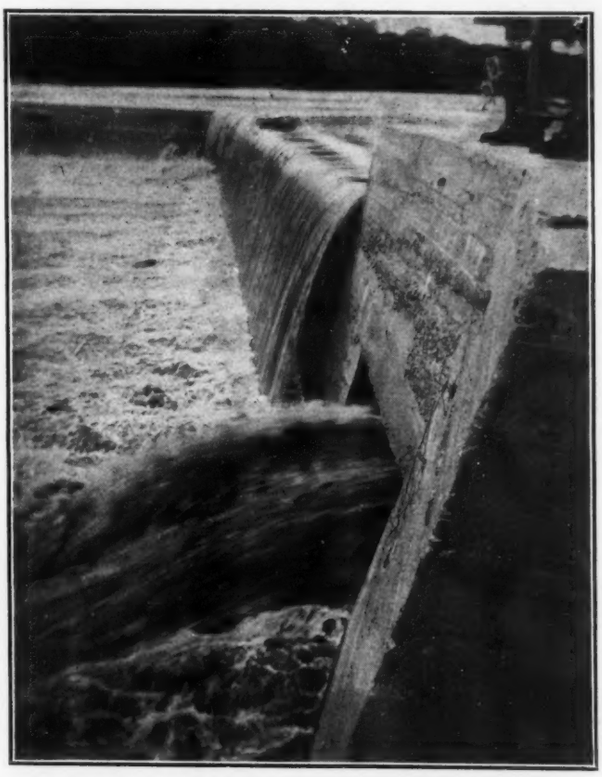


Fig. 1—Tail Gate and Spillway of Rocky Ford Hydroelectric Plant.

Protecting the entrance to the head-race, 60 ft. wide, which leads 140 ft. downstream to the power house, is a floating timber log-boom which can be adjusted to the height of the water level at the dam, with varying floods. The trash racks are of ¼-in. steel section, 3½ in. wide, and 18 ft. long, and are separated by distances of 2 in. These rocks are mounted at an angle of 45 deg., so that all entrained material is effectively floated to the surface. For controlling the amount of water entering the penstocks, planks can be inserted between the rack-bars, entirely closing the inlet if desired.

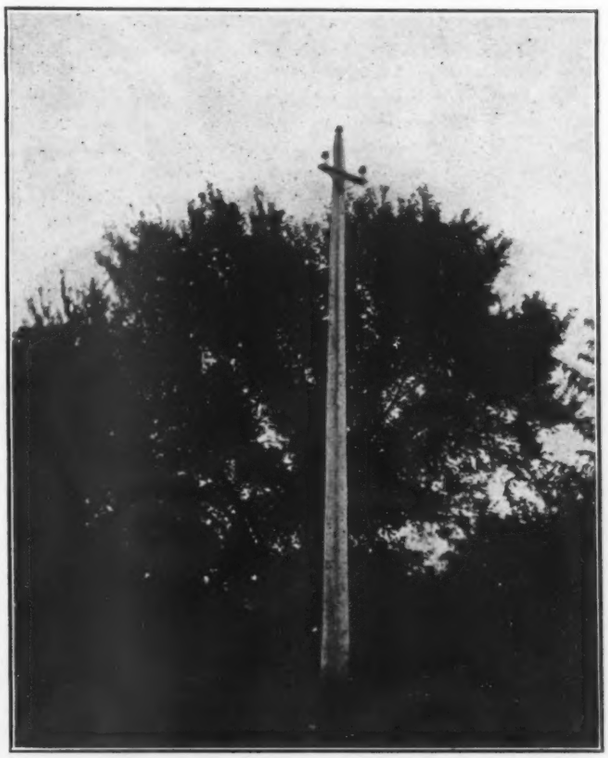


Fig. 2—Reinforced Concrete Pole for Transmission Lines.

The generating equipment comprises two 400-kw, three-phase, 60-cycle, 6600-volt Allis-Chalmers alternators, driven by Leffel pressure turbines. The speed is controlled by a Woodward mechanical governor, and the voltage is automatically adjusted by a Tirrill regulator. Westinghouse electrolytic lightning arresters are used. The output of the station is transmitted at generator pressure, 6600 volts, over three miles of concrete-pole transmission line on leased right of way, to the City of Manhattan, where it is purchased by the local electric company for re-sale among its customers.

The concrete poles used in this transmission are 35 ft. in height, tapering from 15 in. in diameter at the base to 6 in. at the top. They are reinforced by four ¾-in. twisted steel rods running through the entire length of the pole, besides an 18-ft. boiler-tube inserted from the base of each pole for additional stiffening. The cross-arms are 4 x 4-in. angle-irons with ⅜-in. webs, each weighing 35 lb., which are braced to the pole by 1¼ x 1¼-in. angle sections. The poles are set at intervals of 260 ft., and carry three No. 1 copper conductors on 13,000-volt insulators.

The Manhattan Light, Ice & Power Company, which is the local distributor of electricity among the 1100 customers in the town of 7000, maintains its steam-generating station for use as an auxiliary in case of high water or accident to the hydroelectric plant. The equipment at the steam station comprises

one 300-kw Westinghouse steam turbine set and one 200-kw and one 100-kw Corliss engine-driven alternator.

The generating company does not sell outright its output to the distributing company, but accepts as its payment for producing the energy a fixed proportion of the amount paid by the consumer, at his prevailing rate. By this arrangement the distributing company pays all the charges for distributing, selling, metering, billing and other local expenses, while the generating company merely produces the energy and delivers it to the Manhattan substation.

The prevailing rate at which electrical energy is sold is about 12½ cents per kw-hour, with discounts for prompt payment. Among the industrial installations served with electricity are two grist mills, having 150 and 130 hp of motors installed, respectively; a cold storage plant with 60 hp, an alfalfa mill with 75 hp, and a planing mill with 40 hp.

About $85,000 has been expended in the construction and equipment of the water-power plant by the Rocky Ford Milling and Power Company. Dr. C. K. Raber is president of the company, and Mr. H. Pierce is secretary and treasurer. The design and construction of the dam and power house were carried out by the officers of the company without professional engineering assistance.

THE BOILERLESS STEAM CENTRAL STATION AT KENOSHA, WIS.

Several useful suggestions for the supply of twenty-four-hour service by central-station companies in towns where factory power plants are located may be gained from the experience of the Kenosha Electric Railway Company, which, from its modern, but boilerless, generating station, supplies energy for lighting and railway purposes at Kenosha, Wis.

The plant of this company obtains its steam from the nearby boiler house of the Simmons Manufacturing Company, operating its turbine generating equipment during fourteen hours of the day and night, and purchases electrical energy from the Simmons plant for distribution to its customers during the remaining ten hours of the working day.

The interests controlling the electric company and the manufacturing concern are entirely independent, and this arrangement of co-operation between the factory power plant and the electric company's new generating station was instituted only

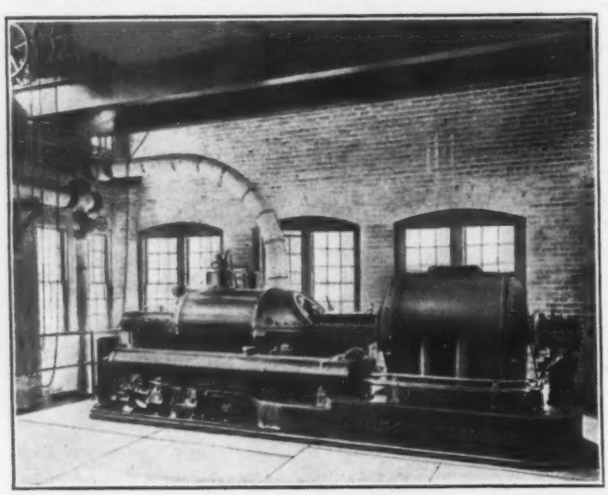


Fig. 1—Turbine Generator in Kenosha Power House.

to take advantage of the unused steam and electrical generating capacity of the factory plant, at the same time providing a most flexible means of interchanging service which is very satisfactory to both parties. When it is necessary to operate one or two departments of the factory overtime the Simmons company purchases energy from the electric company, without being put to the trouble and expense of keeping its own large units running; and it also has at all times the benefit of the lighting and standby service supplied by the central station.

The Simmons Manufacturing Company is one of the largest makers of brass bedsteads in this country, and in its great Kenosha factory employs about 6000 people. Motor drive is used throughout the plant, and one of the interesting uses of electricity is that of baking the lacquer on the polished tube

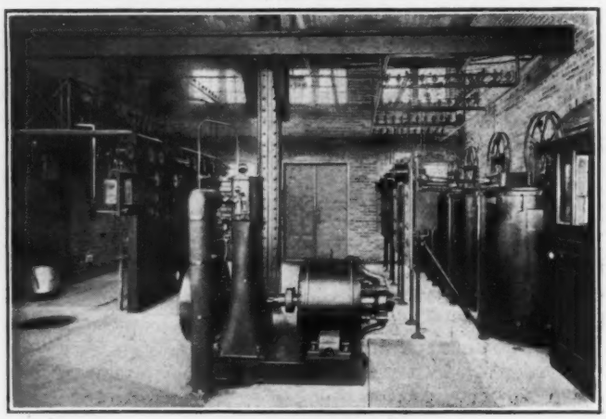


Fig. 2—Switchboard, Exciter and City Arc Rectifier in Kenosha Power Plant.

parts by traversing them with low-voltage current from the secondary terminals of a step-down transformer.

The main generating unit in the Simmons plant is a 1000-kw, 480-volt, three-phase, 60-cycle alternator, driven by a Corliss cross-compound engine. Besides the induction-motor lines to various parts of the factory one circuit of three No. 2-0 wires is led out of the Simmons plant, and across the 40 ft. of intervening space to a bank of three 200-kw, single-phase transformers in the Kenosha Electric Railway Company's station. As shown in the accompanying diagram, 370-volt taps are taken off from the primary side of these transformers for operating the 200-kw, 60-cycle Westinghouse rotary converter which delivers 600-volt, direct-current energy for the local street car lines, operating nine single-truck, two-motor cars. From the 2300-volt side of the transformers the station buses are connected through oil-switches to the turbine-generator armature, the commercial lighting and motor circuits, and rectifier outfits for the 190 Westinghouse metallic-flame arc lamps with which the streets of Kenosha are lighted. The 300-kw turbine-alternator is of the Allis-Chalmers-Parsons type, and runs at 3600 r.p.m., delivering 2300-volt, 60-cycle, three-phase energy into the station buses during about fourteen hours of the twenty-four, when energy is not being received from the Simmons plant. Excitation is furnished by a 10-kw Allis-Chalmers direct-current generator driven by an American Blower Company engine. Both the turbine and the exciter set receive steam at 125 lb. per square inch from the Simmons boilers through a 10-in. header, covered, where it crosses the 40-ft. court between the boiler house and generator station, by a 3-in. layer of asbestos, which is protected by metal sheeting, so that condensation is reduced to a minimum. The turbine exhausts into a 12-in. Tomlinson barometric condenser.

The control of the transformer switches, turbine-generator leads, service lines and the four Westinghouse constant-current arc-rectifying outfits is centered in a six-panel marble switchboard at the west end of the generator room. This board comprises two 2300-volt panels, one exciter panel, one rotary-converter panel and the two series arc panels, besides a Tirrill regulator mounted on a swinging bracket at the left of the board. Besides the usual complement of indicating instruments, recording watt-hour meters are inserted in the station bus lines as shown at *A*, *B* and *C* in the accompanying sketch. The meter at *A* is of the regular station type, but is equipped with a ratchet inserted between its moving element and the registering train, so that only rotation of the armature corresponding to a flow of energy out of the station and into

the Simmons plant is recorded, as indicated by the arrow. By arrangement with the Simmons company the central station pays for its steam on a kw-hour basis, measuring the output of its own generator and adding this to the quantity actually delivered as electrical energy by the engine-driven factory plant. Meters *C* and *B* are of the ordinary type, one measuring the 660-volt railway output and the other the 2300-volt lighting output. The sum of their two readings thus gives the number of kw-hours on which the purchase of steam and electrical energy is figured, and against this is credited the reading from meter *A*, which represents the energy supplied by the electric company to the factory.

As commonly operated the factory engine-driven plant is running during the ten hours of the working day. The turbine-

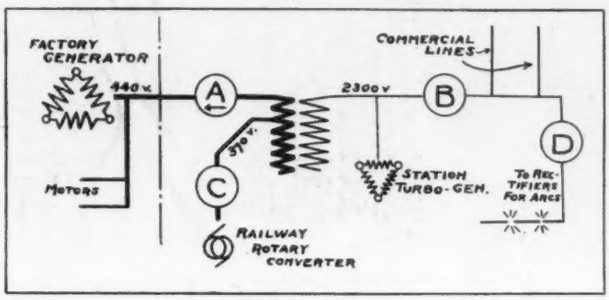


Fig. 3—Arrangement of Meters and Apparatus in System of Kenosha Electric Railway Company.

generator is started up in ample time to take the evening peak of the combined lighting and railway load and ordinarily runs throughout the night until the engine is again running. This arrangement is extremely flexible, as each station enjoys the auxiliary assistance of the other, and in case of light loads or overtime the factory plant need not be run under inefficient conditions. Only one man is required to handle the electric company's generating station, two being employed on twelve-hour shifts, and all the annoyances of a boiler plant are avoided.

The generating station building is of yellow brick, one story high, with a reinforced concrete roof. A five-ton hand-operated crane serves the various pieces of generating and converting machinery. This station was started in operation in August, 1909, the plans being formulated, contracts drawn, building erected, and machines installed complete in sixty days. Mr. S. A. Loughridge is general manager of the Kenosha Electric Railway Company, and Mr. L. A. Pease is electrical engineer.

OFFICE BUILDING POWER PLANT.

The sub-basement power plant of the new McCormick office building, Chicago, exemplifies how proper space allowances can be made in building plans for the important functions which the electrical, steam, hydraulic and compressed-air equipment must discharge in an isolated station of this kind. The building, recently constructed, is a 20-story structure fronting 101 ft. on Michigan Avenue and running back 172 ft. on Van Buren Street. The engine-room, 64 x 80 ft., with a 15-ft. ceiling, occupies the central part of the second basement, two stories below the street level. Behind the engine-room and on the third sub-story level is the boiler-room, whose 28-ft. ceiling is on a level with that of the engine-room.

Coal discharged from wagons in the alley behind the building is delivered by gravity chutes to the concrete-and-steel bunkers, which have a capacity of 260 tons. From these bunkers the coal is again discharged by gravity onto the McKenzie chain stokers serving the three 250-hp Heine boilers, so that in its course from wagons to fire-grates the fuel is delivered without other means of conveyance than gravity. Each chain-grate is individually driven by a ½-hp, 110-volt motor, arranged with a throw-over switch, so that when necessary to speed up the operation of the stokers the motor can be accelerated by connecting it across a 220-volt circuit. The motor guarantee provides for successful operation under this rigorous treatment, and the grates are sometimes operated at high speed for several hours in succession. The boiler-feed pumps and auxiliaries are all steam-driven. Steam from the boilers is delivered to a 12-in. main header, from which 6-in. and 8-in. lines lead to the various engines and pumps on the engine-room floor.

The mechanical equipment of the engine-room has been divided into two sections, all the electrical generators being

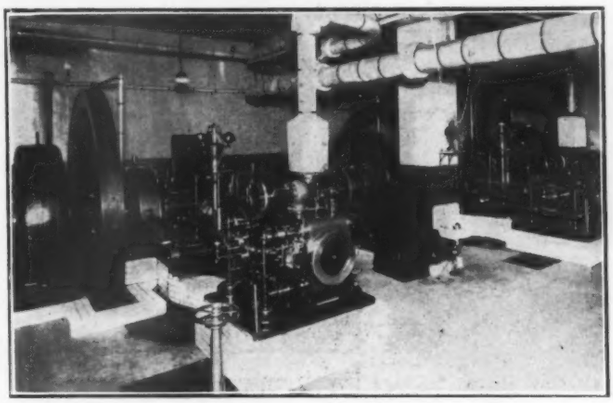


Fig. 1—Generating Units.

installed in the south half of the room, while the elevator pumps, house pumps, air compressors and auxiliary machinery occupy the north half. At the east end of the broad aisle running between the two groups of machinery is the electrical switchboard, while at the opposite end are the various pressure gages.

The three engine-driven, direct-current, generating units, of 250, 175 and 100 kw each, respectively, are composed of Filer & Stowell heavy-duty Corliss engines driving Crocker-Wheeler 220-volt direct-current generators. By this choice of capacities of the generating apparatus, units are provided of one-third

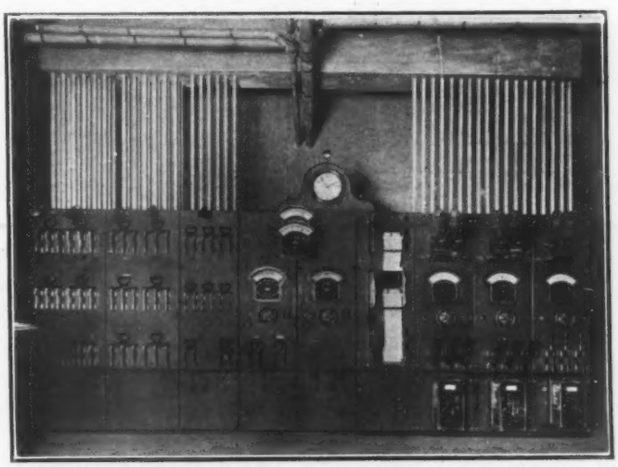


Fig. 2—Switchboard.

and two-thirds the full-load demand in the station, making one set always available for operation under most favorable conditions of load and efficiency. The switchboard, constructed by Kohler Brothers, Chicago, comprises the three generator panels, complete with circuit-breakers, ammeters and watt-hour meters; a recording meter panel containing a Westinghouse graphic voltmeter and Westinghouse graphic ammeters on the lighting and power circuits; two compensating panels, and three lighting panels. The indicating voltmeters are mounted on swinging brackets. To the right of the switchboard are installed the two Crocker-Wheeler compensators, one 50-amp and one 100-amp set.

For supplying compressed air to the thermostat valves used to control the room temperatures automatically two 4-hp motor-driven compressors are installed. Compressed air for the use of tenants and for various purposes throughout the building is furnished by a 12-hp motor-driven pump.

The advisability of installing a vacuum cleaning system throughout the building, exhausted by pumps in the basement, was studied carefully before the building was erected. It appeared, however, that the present equipment of three large, portable Duntley cleaners, driven by individual ¾-hp motors, might be expected to perform the work more satisfactorily, flexibly and economically than the vacuum piping system. The portable arrangement avoids the necessity for drawing and maintaining a vacuum on all or part of the entire piping system, in order to clean one or more rooms. The various apartments are cleaned at different regular intervals, as meets their individual requirements, and if a house vacuum system were installed during much of the time the entire exhausting capacity would be kept in operation to maintain the proper vacuum for a relatively disproportional result.

Three 6-hp ventilating fans are in operation for supplying fresh air—on the twentieth floor, basement and sub-basement.

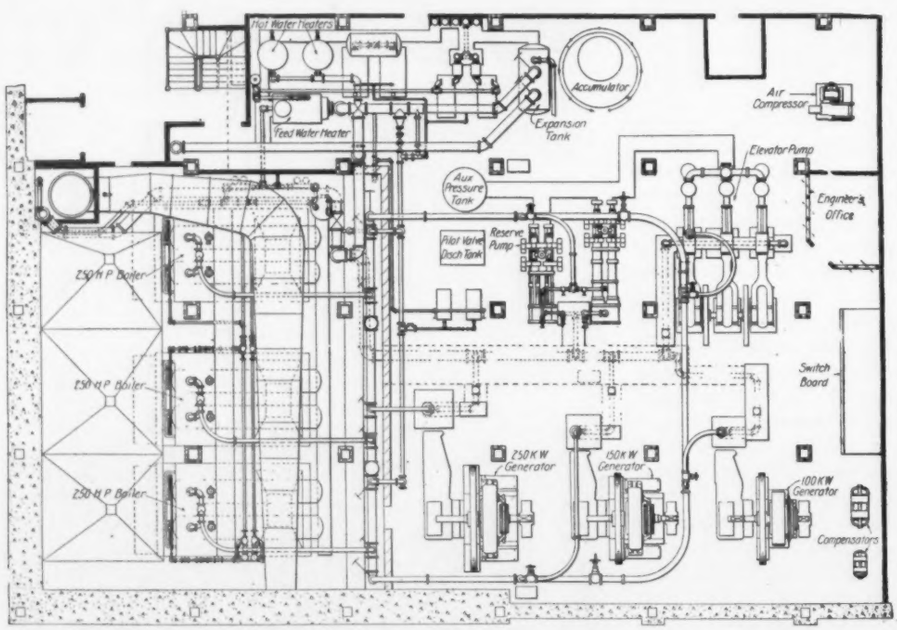


Fig. 3—Plan of Engine and Boiler Room, McCormick Building, Chicago.

All drainage from the building and engine-room is collected in a sump beneath the sub-basement, the sump level being 40 ft. below the level of Lake Michigan. This sump is arranged to be emptied by two Yeoman ejector motor-driven pumps, in addition to which an emergency steam ejector is supplied.

The main floor of the building is occupied by a leading firm of jewelers, whose workshop is in the twentieth story. Connecting this floor with the basement is a Roundtree dumbwaiter, driven by a 10-hp motor, which is used for conveying goods between the store and work rooms. The nine passenger and two freight elevators are hydraulic-operated.

The various fixtures in the office rooms contain 7500 outlets. This service is measured by more than 500 Sangamo mercury-type meters, varying in capacity from 100 amp to 5 amp. Distribution throughout the building is accomplished by two wire shafts, each containing three sets of 110-220-volt, three-wire risers. For wiring purposes, each floor is divided in half, and six half-floors are served by each riser. About 75 hp in motors is installed in the building and power plant.

Holabird & Roche were architects for the building. Mr. M. T. Kimman is chief engineer of the building.

A LARGE ELECTRIC VEHICLE GARAGE AT TOLEDO, OHIO.

"The largest garage in Ohio" the claim reads, and in point of ground covered probably one of the largest in the United States; the institution best known locally in Toledo, Ohio, as the Twenty-first Street Garage deserves other distinctions for its progressive management and up-to-date service than those of mere size.

The Twenty-first Street Garage has comfortable accommodations for more than 175 machines, both gasoline and electric, and is usually well stocked with "boarding cars" in spite of the fact that in Toledo, to an extent seen nowhere else, automobile owners have their own private garages. A ride through the better-class residence streets of the city discloses a garage building behind almost every house, and frequently the home of the machine approximates in size and architecture that of its owner. Besides the innumerable small private garages everywhere, a few neighborhood co-operative affairs are in operation, where a small group of automobile owners club together and build a six-car or eight-car garage to house their machines, employing a man to do the washing and delivering. Toledo is also unique in the large proportion of electric vehicles among the automobiles of the city. There are probably more than 500 of these cars—exceeding in number any city twice Toledo's size. The electric vehicle fad has grown healthily there on account of the city's level, well-paved streets and perhaps also as a result of its large well-to-do population. Electric vehicles are also found cheaper to maintain than gasoline cars, while their pleasant, dignified operation seems better suited to the needs of many of the community.

The floor space of the Twenty-first Street Garage is divided into two large rooms, one of which, 60 ft. x 220 ft., is used entirely for electric vehicles. This room has accommodations for more than 100 cars, and provides equipment for charging thirty cars simultaneously. The electric vehicle section is separated from the gasoline-car room by a brick fire wall pierced at front and rear by wide openings protected by steel fire doors. The one street entrance, in the gasoline-car section, is used by all the automobiles in the garage, as shown in the accompanying plan of the building. The purpose of this arrangement was to institute a system of checking so that those in the glass-windowed office in the front could know of all car movements. Next to the office is the drivers' waiting-room at the left of the entrance. From here the garage chauffeurs can be easily summoned from the street, as electric customers frequently stop by the building on their way home to pick up a driver, who returns the car to the garage. At the other side of the office is a large show space for new cars, for which the garage acts as agent.

At the rear of both the electric and gasoline-car areas are the respective repair shops. The gasoline workroom communicates by elevator with a varnish and paint shop on the second floor. Just outside the electric workshop is the rectifying and charging switchboard.

Alternating-current energy is received at 110 volts, 220 volts and 440 volts, 60 cycles, from secondary taps in a transformer of the Toledo Railways & Light Company, which supplies the local lighting and motor service. The charging equipment comprises five General Electric mercury-vapor rectifier outfits as-

sembled in a switchboard of five rectifier and five switching panels, which provide for charging thirty cars simultaneously. These panels are so arranged that 110-volt, 220-volt or 440-volt energy can be drawn upon to secure the most efficient conditions, dependent on the number of cars to be charged, the outlets being arranged for connection in series as needed. From the switchboard sixty No. 12 copper wires composing the thirty charging circuits are carried straight down the room in porcelain cleats on blocks mounted on the steel roof trusses. At each of these trusses, which are at 8-ft. distances, two charging circuits are carried to the adjacent wall, as shown, and down to knife switches to the lower clips of which are attached the charging cords ending in the machine plugs. With the exception of one pair of lines all of the charging outlets are on the center-wall side of the room. Along the walls behind the rows of vehicles an auxiliary lighting circuit is carried with sockets for plug connection every 16 ft., used for inspecting cars and batteries. Below this are the heating coils of the hot-water system, and at the floor is a wide concrete step 4 in. high and with a 2-ft. top. This step prevents the cars from being backed into the wall and injuring their upper parts and also provides a clear passageway along the wall behind the row of vehicles. The floor is of concrete and drains to sewer traps in the center.

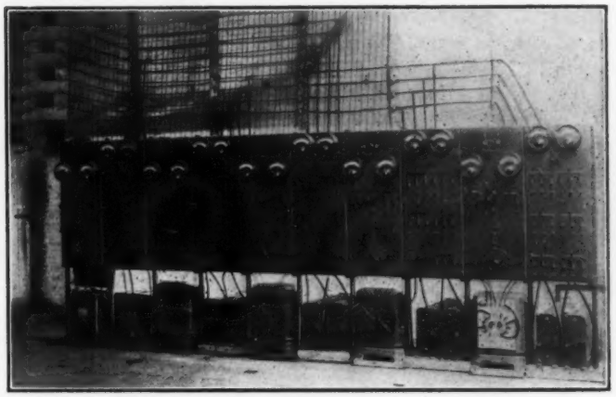


Fig. 1—Charging Switchboard.

The entire floor space is without pillars of any kind, the roof being carried on steel arch trusses with 6-ft. rise placed at 8-ft. intervals. At the center of the arch the roof is broken by an 8-ft. skylight which extends the length of the building and provides a flood of daylight for the garage interior. The artificial lighting is furnished by three rows of seven 32-cp lamps suspended from the roof trusses.

The workroom is equipped with a lathe, drill press and other machine tools which are driven by a 5-hp, 220-volt induction motor. This motor also drives an air compressor used to fill a tank from which tires are inflated. Rain water from the nearly 35,000 sq. ft. of roof surface of the two buildings is collected and passed through a barrel filter at the ceiling level, where it traverses a 1-ft. layer of gravel and several feet thickness of charcoal. From the filter it is led through rubber hose and wooden valves and fittings to the battery-room, where it is used in place of distilled water to replenish the evaporation in the cells.

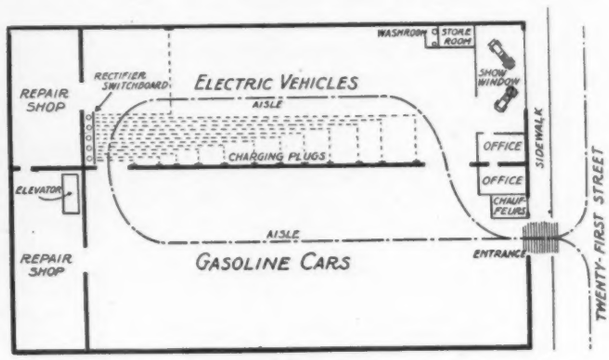


Fig. 2—Plan of Twenty-first Street Garage, Toledo, Ohio.

A system of recording, for the garage men's use, all necessary information about each car is provided by a blackboard tablet mounted at the front of the room. This tablet has spaces for the name of the owner of the car, its tag number and make, and the hour at which it is regularly ordered daily. Three other columns show "In," "Call For" and "Delivered," a marker on a hook over each space showing the last disposition of the car.

Careful records are kept of the battery condition each day of all cars in the garage and a card is filled out showing the voltage and amperes flowing during each hour of the charging operation. Where an odometer is installed on the car this reading is also taken. These cards are preserved and show exactly what amount of charging was given any car during any period, information which is valuable to both the owner and the garage operator.

From records kept in this way for one month recently when 738 separate charging operations were completed it was shown

Fig. 3—Interior View of Toledo Garage.

that each car required on an average 107 amp-hours per day. Taking an average battery pressure of 75 volts this represents about 8 kw-hours consumption per day, or 240 kw-hours per month for each machine.

Regular inspections are made of customers' batteries and a loose-leaf record filled out, a copy of which is mailed to the owner of the car. This record form shows the date, name of owner, name and number of car, number of cells, condition of positive plates, condition of negative plates, amount of sediment in jar, specific gravity of acid and work recommended. It is the aim to place this latter information in the hands of the owner at least two weeks before the trouble may become annoying or serious so that convenient arrangements can be made for withdrawing the car from service while it is being repaired. Date lines to be filled out when the work recommended has been done complete the record.

For "boarding" an electric automobile the garage receives $22.50 per month, which includes charging and supervision of battery, washing and delivering and calling for the car. A rate of $27.50 a month has also been offered, in return for which it is agreed to keep the machine in repair at all times,

THE TOLEDO AUTO & GARAGE CO.

CHARGING CARD

Date ..... *191*.....

Owner .....

Address .....

Make and Type of Car .....

No. of Cells ..... *Odometer Reading* .....

P. M.			A. M.		
Hour	VOLTS	AMP.	Hour	VOLTS	AMP.
1			1		
2			2		
11			11		
12			12		

REMARKS

CHARGED BY .....

Fig. 4—Record Form.

assuming all the minor replacement and repair costs and guaranteeing frequent mechanical inspections of the car to anticipate trouble. The latter rate has not met with the appreciation among owners which it seems to deserve, the average owner preferring the minimum "boarding" charge, by which he probably thinks to save.

The Toledo Auto & Garage Company operates the garage above described. Mr. A. U. Campbell is manager of the company.

ELECTRICAL ENERGY IN STEEL WORKS CONSTRUCTION.

Extensive use of electricity is made in the construction of the new steel works of the Minnesota Steel Company, at New Duluth, near Duluth, Minn. The works will represent an investment of $10,000,000 or more, and construction work has been under way for some time. A temporary steam-driven electric generating plant, rated at about 500 hp, has been installed, and a cement plant, hoists, derricks, conveyors, etc., are operated by motors supplied with electricity by temporary circuits. The company is itself doing the construction work.

CONSTRUCTION OF FOUNDATIONS FOR ELECTRICAL MACHINERY.

By Bruce H. Page.

As a rule, concrete machine foundations as designed in drafting rooms and engineering offices are needlessly intricate. The actual contour of a masonry foundation may be almost any reasonable one that a designer selects without increasing the cost of the foundation much, because with masonry foundations forms are not required. Forms, which are in a majority of cases required in the construction of concrete foundations, are relatively expensive to construct. Hence, the design of a foundation should be such that they will be as simple as possible.

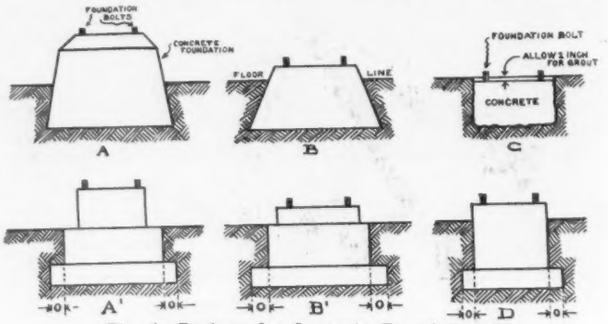


Fig. 1—Designs for Concrete Foundations.

The type of machine foundation shown at *A*, Fig. 1, is a favorite with draftsmen, but for what reason the writer does not know. A form for such a foundation, because of the inclined sides, which necessitate beveled corners, is difficult and expensive to construct. In certain cases such a large area of base may be required for a machine foundation to prevent its sinking into the supporting soil that its bottom should be much

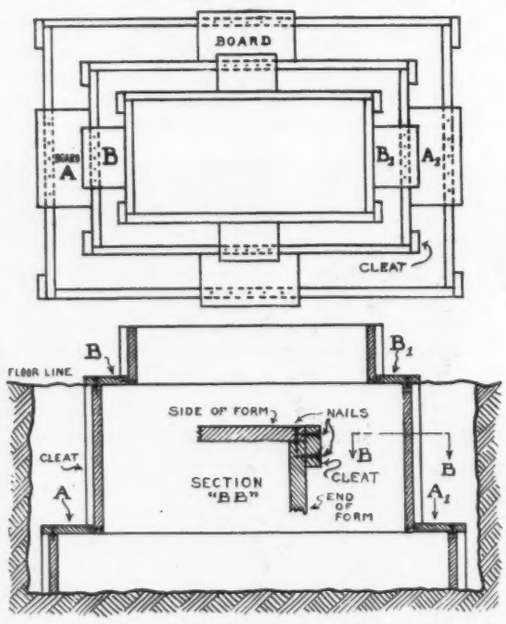


Fig. 2—A Complicated Form for a Concrete Foundation.

larger than the top. In such cases the form for a foundation constructed as shown at *A'*, Fig. 1, will be cheaper than that shown at *A*, although both have the same area of base. A form for the foundation *A'* is shown in Fig. 2. All of its sides are vertical and all of its angles right angles. However, such a form is expensive and should not be used if a simple foundation and form such as shown in Fig. 3 will do.

The form of Fig. 2 consists essentially of three boxes of different sizes without tops or bottoms. In erecting, the lower box is first placed in the excavation and braced with blocks wedged between it and the sides of the excavation. The box is then

tamped full of concrete. Next the box above is arranged in proper position on the green concrete and held in position by the pieces of board A and A_1, shown in Fig. 2. It is filled with concrete and the third box located, blocked in position with the pieces B and B_1 and filled. The corners for this or any other similar form should be made as shown at *Section BB*, Fig. 2, so that the boards will not be forced apart by the concrete-ramming process.

Where this type of a "sectional" form is used it is necessary to support the foundation bolt templet on a frame, inasmuch as it is impossible to support it on the form. A form can be used for a templet support when the form is of the plain de-

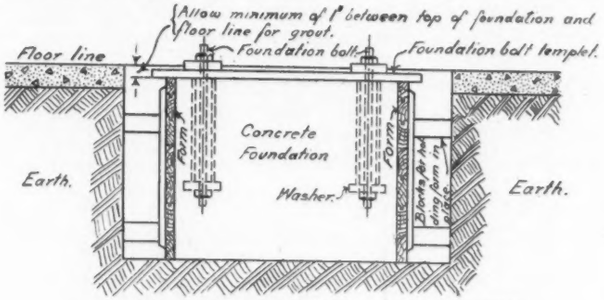


Fig. 3—A Simple and Sensible Form in Position.

sign shown in Fig. 3. B' (Fig. 1) shows how the foundation shown at B can be modified into one having an equal area of base that can be built with easily constructed forms. At D is shown another design. In this case a certain area of foundation base was necessary to support the load. A smaller area of top was sufficient to include the foundation bolts and provide a rest for the machine. The foundation was erected as shown. It could have been made with vertical sides, its top having the same area as its base, but the value of the concrete saved through the use of the extended footing was much more than sufficient to pay the cost of the additional form construction involved.

In designing foundations such as those indicated at A', B' and D (Fig. 1) care must be taken that the "offset"—the distance o, Fig. 1—be not so great that the footing will crack off as indicated in Fig. 4. Rules are given by which the safe "offset" distance for commonly used masonry construction materials may be determined.

Frequently concrete foundations can be built, as shown at C, Fig. 1, without any form at all where the soil is firm enough to support itself. The excavation can be made, the foundation bolt templet located and supported by a frame and the mixture tamped directly into the hole. Obviously this procedure is only

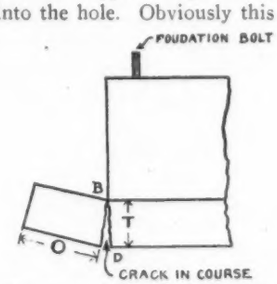


Fig. 4—A Failure of a Footing.

practicable where the foundation is of simple shape. In the example shown at C (Fig. 1) 1 in. is allowed for grout at the top of the foundation, so that the bottom of the base of the machine to be supported will lie flush with the floor line.

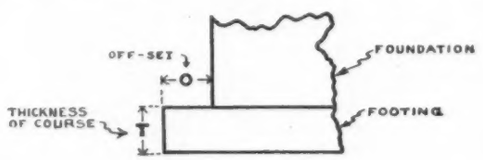
Templets for plain foundations like that delineated in Fig. 3 can be supported directly on the top of the form and attached thereto with a few nails. The foundation itself is of the plainest possible contour. The forms for it can be easily and cheaply made. This construction can be profitably followed in a great majority of cases where small machines are involved. It will be usually found that the area of base will be ample to prevent sinking if it be made the same as the area of top. The area of top is determined by the dimensions of the machine to be carried. The top must be big enough to include all of the foundation bolts and to carry the base of the machine. Whether or not a certain area is sufficiently large can be ascertained by referring to the table giving the bearing power of soils in the August number.

As suggested above, there is a tendency for the projecting part of a footing to break off along the line BD, Fig. 4. This projecting portion may be treated as a cantilever beam. The section represented by BD offers resistance to bending. The load causing the tendency to break is the reactive pressure of the soil upon which the footing rests. It is evident that there is, for any given material, pressure against the soil and thickness (T, Fig. 4), a safe distance O, which should not be exceeded. This distance may be computed with sufficient accuracy for all practical purposes by the equation:

$$O = \frac{1}{7} T \sqrt{\frac{R}{Pf}}$$

in which O = the greatest possible safe offset or projection of the footing course in inches; T = the thickness of the footing course in inches; R = the modulus of rupture of the material (given in Fig. 5) of which the footing is composed, in pounds per square inch; P = the pressure, in tons per square foot, at the bottom of the footing course under consideration; f = the factor of safety. This equation and the table in Fig. 5 were compiled from matter in *Masonry Construction*, by Baker. The reader who wishes to study the subject of footing proportions further is advised to consult this work.

Obviously there is a relation with a given material and foun-



Material Composing Footing.	Modulus of Rupture in Pounds per Sq. Inch.	O in terms of T for a pressure, in tons per square foot, on the bottom of the course, of		
		0.5	1.0	2.0
STONE				
Bluestone, North River	5,026	4.5	3.2	2.3
Granite	1,849	2.7	1.9	1.4
Limestone	1,377	2.4	1.7	1.2
Sandstone	1,378	2.4	1.7	1.2
BRICK-WORK				
Good building brick in poor 1:2 natural-cement mortar, age 50 days	120	0.7	0.5	0.3
Under-burned building brick in 1:3 Portland cement mortar, age 76 days	706	1.7	1.2	0.8
Vitrified building brick in 1:3 Portland cement mortar, age 76 days	3,506	4.3	2.7	1.9
CONCRETE				
1:2:4 Portland cement at 1 month	300	1.1	0.8	0.5
1:2:4 Portland cement at 6 months	400	1.4	0.9	0.6

Fig. 5—Safe Offsets for Masonry Footing Courses, Factor of Safety = 10.

dation pressure between the thickness of T (Fig. 4) and a safe projecting distance O. For reference the table, Fig. 5, is given, which shows safe offset distances for materials and loads ordinarily encountered in foundation work. A factor of safety of 10, which is about right for average conditions, was employed in computing the table. Where masonry or brickwork is involved the values given in the table (Fig. 5) are not true unless the stones or bricks are well bedded, have a thickness equal to the thickness of the course and project not more than half of their length. For concrete the ratio of O in terms of T varies from about 0.5 to 1. Inasmuch as foundations are frequently quite green when machines are mounted on them, it is not unusual to use the ratio 0.5; assuming a pressure against the soil of ½ ton per square foot. A footing, for example, of the proportions indicated in Fig. 6 would result from this as-

sumption. A three-step footing like the one shown would only be justified where the machine carried was excessively heavy and a large area of base is imperative.

A three-step footing is shown merely for an illustration of the principle. Obviously the dimensions of 8 in. and 16 in.

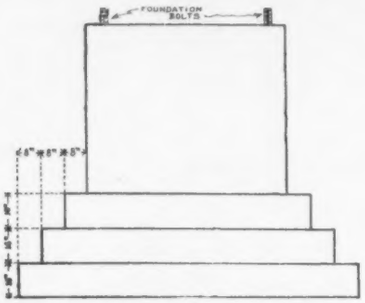


Fig. 6—A Three-Step Footing.

would hold true if the footing had only one step or had two steps.

In general, no concrete footing should be less than 8 in. in thickness; thinner ones are too delicate. The constructor is urged to avoid footings altogether where he economically can do so and to build foundations of ample base area with plain, vertical sides. In each doubtful case it is a question of form cost versus concrete cost.

MOST ECONOMICAL METHODS OF CARRYING PEAK LOADS.

A discussion of the most economical methods of carrying peak loads, with special consideration of fixed charges, written by Mr. H. G. Stott, of New York, forms part of the committee report on power generation presented before the recent meeting of the American Street and Interurban Engineering Association. The author devoted the major portion of his discussion to the question of economical production of energy, which he fears is not so clearly understood as might be wished, especially as regards peak loads. The curve printed herewith shows the total maintenance and operating costs per kw-hour for various percentages of load-factor below the horizontal axis, while the curve above this axis shows the fixed charges per kw-hour for various load-factors. The sum of the ordinates above and below the axis gives the total cost of energy under the conditions which have been assumed.

From a consideration of these curves it will be seen that for peak loads having an annual load factor of from 5 per cent to 15 per cent the operating and maintenance charges are relatively unimportant and the fixed or capital charges are of the greatest importance. The various sources to be considered for peak loads are given as follows: Storage batteries, purchased energy, hydroelectric energy, gas engines and steam turbines. The author then makes the following analysis:

A storage battery would seem at first sight to be an ideal means of carrying peak loads, as obviously it would not call for any additional plant capacity, but if the double curves are applied to it, it will be found that the fixed charges, on a battery capable of discharging at its maximum rate for two hours at a time, are so high as to leave it out of the question.

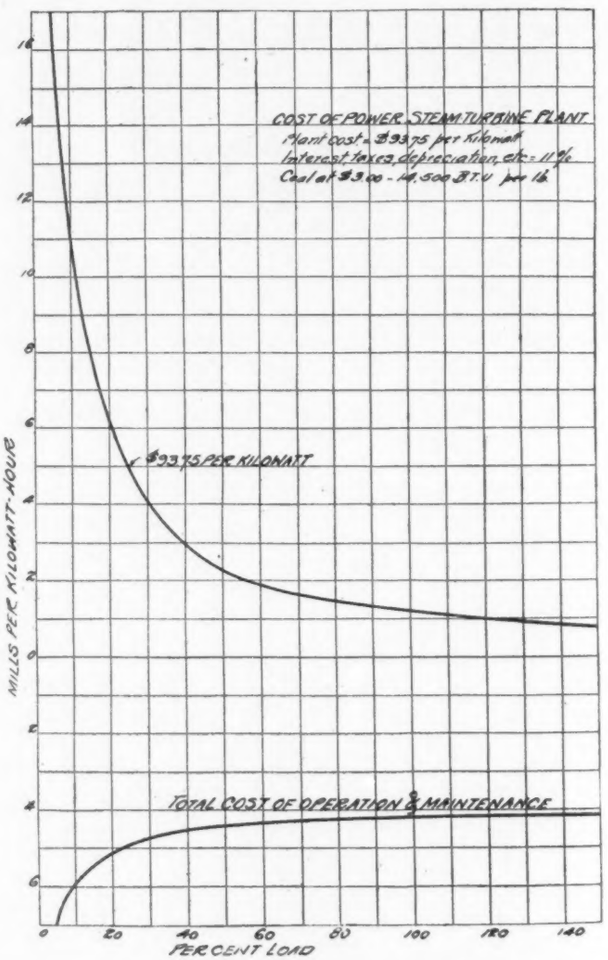
Purchased energy almost invariably carries a heavy fixed charge per kilowatt of maximum demand, varying from $15 to $25 per kilowatt per annum, with a further charge per kw-hour actually used. The first charge should be treated as a fixed charge and so plotted above the axis. This will in all probability show an extremely high cost per kw-hour of peak load.

Hydroelectric energy if transmitted more than a few miles will inevitably show very high fixed charges, owing to the large investment in the power plant, hydraulic development, transmission lines, etc.

Gas engines, while attractive from the point of view of small cost for fuel during the period the plant is idle, are inadmissible from the point of view of high fixed charges due to the large investment per kilowatt.

Steam turbines are at present the most satisfactory type of prime mover in the market for the peak-load problem, owing to their low first cost. If a reciprocating-engine plant in good condition is available, then the addition of low-pressure turbines will result in the development of a kilowatt at an investment of about $25, provided there is enough room available in the engine-room and if the boilers can be forced sufficiently to carry the extra load.

In the boiler-room the investment can be kept down by adding grate surface instead of more boilers, and by the use of forced draft the old rating of 10 sq. ft. of heating surface per boiler horse-power can safely be reduced to 4 sq. ft. or 5 sq. ft.



Curves of Maintenance and Operating Costs and Fixed Charges.

without materially adding to the cost of boiler or furnace maintenance.

While the over-all boiler efficiency will begin to fall off gradually beyond 175 per cent or 200 per cent rating, the small loss thus entailed is insignificant compared to the saving in fixed charges as shown in the curves.

According to Mr. Stott, the solution of the problem of carrying peak load economically is, therefore, to be found in reducing the investment per kilowatt to a minimum, and this can be best accomplished at present by the use of steam turbines and by the use of large grate area, such as a ratio of 30 sq. ft. or 40 sq. ft. of heating surface to each foot of grate area, instead of the present ratio of 55 or 60 to 1. Forced draft may be employed with advantage with any grate area and will in almost any case result in increased economy as well as in increased capacity.

LETTERS ON PRACTICAL SUBJECTS

A METHOD OF RAISING INVERTED MOTORS.

There are many methods of raising an inverted motor to a location on a ceiling. The one outlined herein will be found excellent under certain conditions. Fig. 1 shows how the tackle is arranged and Fig. 2 illustrates a plan view at the second floor. In the method described here the inverted motor is raised with two ropes. Each passes through a foundation-bolt hole in the bed-plate, is arranged around the motor frame and is made fast in the eyebolt at what is normally the top of the motor. The two holes in the bed-plate through which the hoisting ropes pass are located at diagonally opposite corners. The hoisting ropes, after being made fast to the motor, are threaded through two of the four holes which have been bored to accommodate the bolts in the stringer pieces which will support the motor. Then the ropes are carried through two accurately located holes in the floor above. On this floor rests a horse which supports the two sets of blocks with which the motor is raised. As indicated in Fig. 2, the horse is arranged diagonally so that it is directly over the two holes in the floor through which the hoisting ropes pass. Sometimes instead of using a horse to support the tackle, it is best to arrange temporary eye-bolts in the floor of the story next above as shown at *A* and *A*. They can be readily removed when the motor has

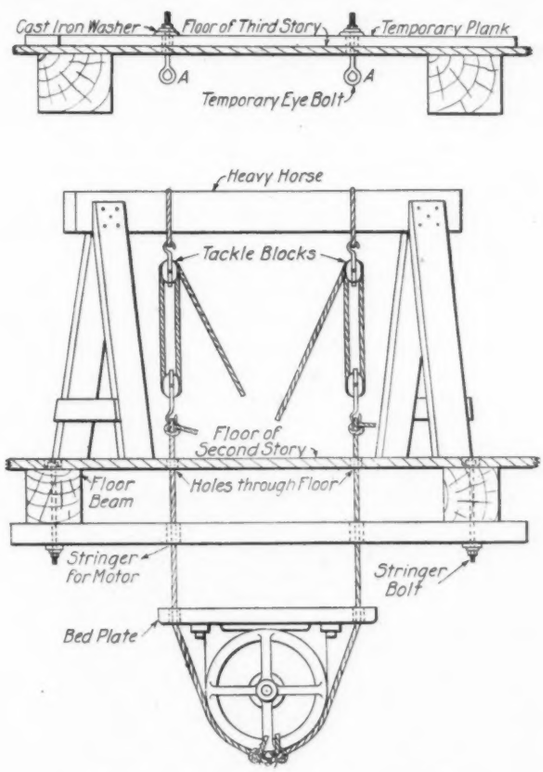


Fig. 1—Side Elevation of Hoisting Outfit.

been raised, but can be quickly replaced when the motor must be replaced or taken down. After a motor has been raised to its position on the stringer planks two bolts are inserted through the open holes and set up tightly. Then the hoisting ropes are pulled out and the other two bolts are inserted. It should be noted that with this method it is not necessary to cut any large holes in floors. The stringer pieces having been bolted to the beams, the four holes, two in each stringer, for the four motor-supporting bolts are located and bored in them. These holes should be at least ⅛ in. greater in diameter than the diameter of the supporting bolts. Then the two holes for the ropes are bored through the floor above. If a bit long enough is available this is easily done by using the holes in the stringers as guides and boring with the lower end of the bit

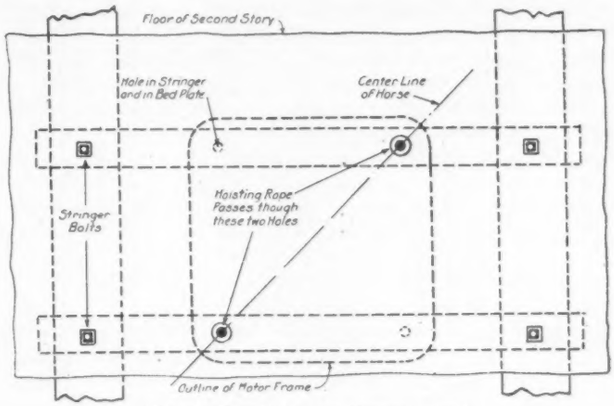

Floor of Second Story
Hole in Stringer and in Bed Plate
Center Line of Horse
Stringer Bolts
Hoisting Rope Passes though these two Holes
Outline of Motor Frame

Fig. 2—Plan View on Second Floor.

through one of them. If no long bit is at hand the locations of the floor holes can be accurately determined with a plumb-bob, as shown in Fig. 3. The floor holes should be generously large so that they will not bind the hoisting rope. When buying a motor for inverted ceiling mounting or for mounting in any

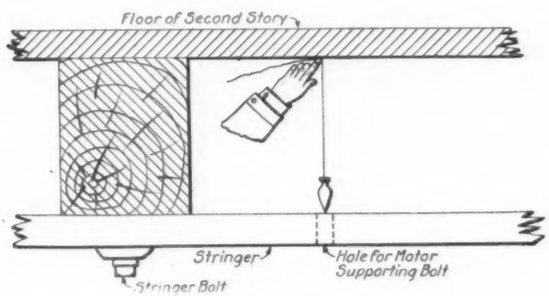


Fig. 3—Method of Locating Bolt Holes.

position, one should be selected which has a single bed-plate instead of two slide-rails. It is much more difficult and tedious, therefore expensive, to line up and level two slide-rails than one bed-plate. Furthermore, the slide-rails will require at least twice as many supporting bolts as will the bed-plate.

Pittsburgh, Pa. H. T. BOYNTON.

CARE AND LUBRICATION OF BEARINGS.

Bearings run hot or excessively warm from one or more of the following causes: When the tension of the belt is excessive, when too much load is imposed on the bearing, when the boxes are not properly fitted for the journal, when there is an improper distribution of the oil over the entire surface of the journal, and when the boxes are pressed too tightly against the journal. These are the five principal causes of hot bearings. When an excessive load is imposed on the journal by reason of the belt being pulled too tightly, the belt will usually indicate the trouble by waving on the pulling side. If the oiler or attendant is not aware of this fact he will tighten the belt more in order to stop its waving, thus increasing the difficulty and the liability of a hot bearing. When the belt waves on the pulling side the oiler should feel the bearing; if the bearing is cool the belt can be tightened, but if there is an indication of a rise in temperature then the belt must be run slack. This is one great cause of hot bearings, because it imposes an excessive load on the journal. When a bearing runs hot from an improper distribution of oil the oil may supply only one end of the journal, thus causing the opposite end to

run dry or without a sufficient quantity to insure lubrication. This particular cause is often associated with hot bearings and is difficult to detect because the cap of the bearing would have to be removed in order to discover the trouble. After the cap is removed it will be easily found owing to the difference in color of both ends of the journal. The oil will not be distributed evenly over the journal surface when the boxes impinge on some particular part of it. The box may be fitted badly to the journal, permitting an edge of the box to act as a wiper or scraper; the edge being so close against the journal that it is impossible for oil to find its way between the box and journal. The box may also be without oil grooves. If one stands facing the journal and rotation is toward the right, then the upper edge of the right-hand box parallel with the journal should be cut away, otherwise the oil will flow over the box and not between the box and journal where it is needed. Bearings will run hot from a stoppage of the oiling rings, if ring oilers are used, or if chain oilers are employed the chain may kink, which will surely prevent it from traveling, and thus a hot bearing is the result. When ring oilers are used the ends of the rings should be soldered evenly together and no burr should be allowed to protrude on their surface so as to catch in like projections that might be on the surface of the ring ways cut in each bearing. If an oil cup is used to feed the bearings with oil the cup may become clogged, which, of course, could be easily detected before any serious heat developed, especially if the drop or stream of oil is compelled to pass by some opening in the shank of the cup. The opening or view-hole should be protected from air currents by either a glass or mica tube, because if the drop is exposed to strong air currents it is liable to be blown out of line of the oil pipe and forced to drop away from the place where it is needed. If no glass or mica tubes are obtainable the oiler can readily aid matters by making a tube out of a thin sheet of mica and substituting it for the regular tube. When bearings are oiled by the gravity system a pump is usually employed to return the oil discharged from the bearings to the gravity tank, from which it flows to the different bearings through brass or iron piping, the flow of oil to each bearing being controlled by a cock or valve situated in a handy position. If the oil is passed through a filter before it is deposited in the gravity tank a considerable amount of deleterious matter which combined with the oil during its passage through the bearings will be removed. The oil should not be taken from the bottom of the gravity tank, but should be taken some distance above the bottom, because doing so eliminates all chances of water flowing into the oiling system. The gravity tank is in nearly all cases fitted with a gage glass, which enables the oiler to see at a glance the height of the oil in the tank, and if any water is present it will appear at the base of the glass, in which case it can be run off by means of a valve located in the bottom of the tank. The glass will also indicate when a fresh supply of oil is needed, hence a continuous flow of oil through the oiling system is assured. Bearings are also oiled by water pressure or air pressure, and in numerous cases oil is pumped directly through the bearings. When oil is pumped directly through the bearings the oil pump may be independently operated by means of a variable-speed motor or else the pump may be driven direct from some rocker shaft on the engine. When the variable-speed motor is used no by-pass is needed because the speed regulator has sufficient resistance to compel the motor to run at a low speed. If the oil supply is not enough the motor can be speeded up, thus increasing the quantity of oil on the bearings. When the oil pump is driven by the engine its speed cannot be changed, and in this case a by-pass is needed to regulate the flow of oil. (Of course, a by-pass can also be attached to the motor-driven pump if required.) There is one great danger attached to the above system of oiling. When such a system is in use the returning oil from the different bearings will contain water to a greater or less degree, caused by the condensation of any steam that happens to blow through the stuffing boxes into the interior of the engine bed, the steam striking against the cold metal condensing and falling to the bottom or lowest part of the engine framework, where it mingles with the returning oil and eventually arrives in the vessel from which the pump takes its supply. As soon as the water has risen high enough it will prevent the pump from receiving oil, and water will be discharged on the different bearings, increasing the liability of heat. The remedy is to run off the water and pour into the oil vessel a fresh supply of clean oil. At first when the water begins to mingle with the oil it will change the oil to a whitish color; the amber color of the oil will no longer be present and this indication should cause immediate attention to be given to the oiling system. If the oil vessel is fitted with a gage glass an incandescent lamp should be placed in a position which would give the oiler or attendant a good view of the glass and show water as soon as it has taken the place of the oil. When oil is circulated by air pressure the same trouble will arise as in the previous-mentioned case. When oil is circulated by water pressure no water can be forced through the bearings, because the oil is compelled to issue from the upper portion of the pressure oil tank and, of course, any water in the oil must fall to the lowest point. But when air pressure is used the oil is forced from the bottom of the tank and any water present will surely find its way into the oiling system. Where plants are equipped with any of the above oiling systems there is no need of running the bearings too near the danger line for the sake of economizing oil, because with any of the above systems the same oil is used over and over again. The only precautions necessary are to filter and clean the oil and to see that the bearings receive a sufficient quantity at all times to maintain them cool. After a bearing runs hot, necessitating shut-down, the boxes should be taken out, all roughness removed from both the boxes and journal, the oilways cleaned and the boxes put back in position. When a box is put back the screws which hold it against the journal may first be made hand-tight, then after running a while they should be tightened a little more, and in this way the correct amount of pressure be placed on the boxes. An expert in such a case would require only one or two trials to adjust the boxes properly, but those who are not expert should tighten up the bearings gradually. Should the temperature of a bearing rise there is no need of becoming unduly frightened. The engineer should see that the bearing is receiving oil, and if the temperature continues to rise, try to locate the difficulty. The heat may be caused by excessive tension on the belt, in which case the belt should be slackened. If this cannot be done, the bolts that hold the boxes against the journal should be loosened and the quantity of oil increased. At the plant with which the writer is connected some of the bearings occasionally run up to a temperature which would prohibit a person feeling them with the hand in the ordinary manner, but so long as they can be touched with the tip of the finger they are allowed to run in that condition because the machines cannot well be shut down when heat develops.

New York. WILLIAM KAVANAGH.

THE TROUBLESOME BLOW-OFF PIPE.

When the writer visits one of the neighboring light plants he always makes it a point to get around behind the boiler room and take a look at the boiler blow-off pipes. Very frequently he finds here leaky blow-off valves which are the cause of waste equal to the revenue of a half dozen good consumers. A blow-off pipe is a most troublesome detail. It will persist in leaking unless looked after carefully. One at the writer's own plant was a continual source of annoyance. Sometimes on investigating it was barely running a stream. At other times it was fairly pouring. Each time the boiler was cleaned the valve received attention and occasionally a new one was substituted. Finally he saw an advertisement of a Y-valve made particularly for blow-offs. One was obtained and installed and the blow-off pipe has remained dry ever since. As a precautionary measure, an ordinary disk valve was placed between the new one and the boiler in order that the Y-valve might have attention without emptying the boiler.

Lawrenceville, Ind. CALE B. GOUGH.

RECONSTRUCTING A CENTRAL STATION.

The August number contained photographs and a description of some contemplated changes in the central station of the Indiana & Michigan Electric Company, at South Bend, Ind. The changes in question comprise the erection of a new steel structure in and around the old building, which is filled with electrical machinery which must be kept in operation at all

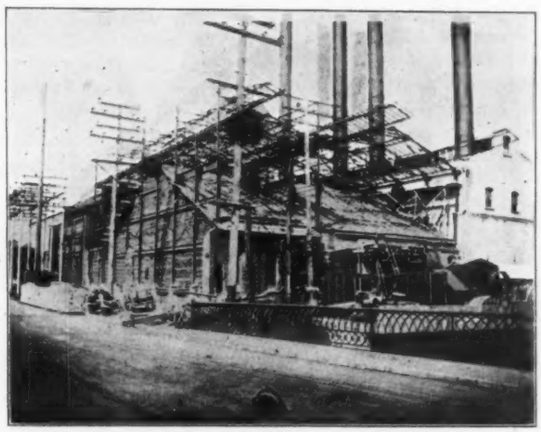


Fig. 1—Side and End Elevation of Power House.

times. New foundations were put in for the new building and this work occupied more than a year. In fact, nearly two years elapsed from the time operations were commenced until the first visible piece of structural steel appeared through the roof of the old station. The half-tones herewith show the progress which had been made up to Aug. 21, at which time the roof framing presented an appearance not unlike an immense flying machine. As the front wall of the new building was to fill practically the position occupied by the front wall of the old building, it was found necessary to take down the brickwork and close the end of the old building with scantling, rough boards and tarred paper. Then the permanent steel framing of the building was put in place, as shown by the engraving. The false front will be removed little by little as the construction of the new walls proceeds. The manner of joining the steel timbering to the wing of the building already erected was

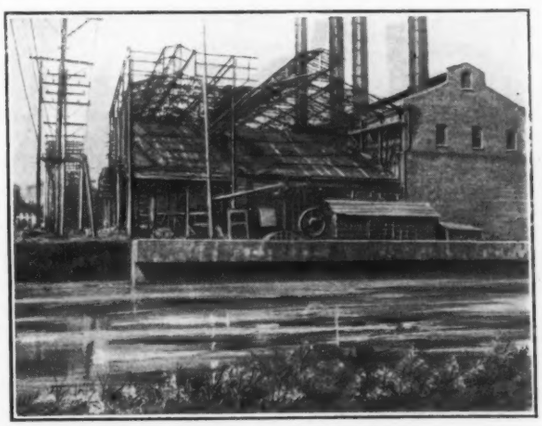


Fig. 2—End View of Power House.

very simple indeed. All that was done was to knock out a few bricks wherever a timber would enter the wall. Holes 2 ft. or 3 ft. square were driven through the wall and the new timbers inserted, fully leveled and aligned and then bricked firmly into the old wall, good, strong cement mortar being used for this work.

Fig. 1 shows the building as seen from the street and gives the side and end elevation of the structure, and also shows plainly the manner in which the structural steel was carried up through the old building. The high-tension receiving poles are shown at the extreme left of this illustration. Fig. 2 is an end view taken from across the canal and shows the manner in which the building is divided into two sections or bents, one of which is much wider than the other. To keep the old building water-tight while the work is going on has proved quite a task, but it has been successfully accomplished. Other problems equally serious are sure to arise when the time comes to demolish the old structure, and a good deal of expert engineering will be required to remove successfully all the material in the present building without dropping any matter whatever into the generating machinery, which is constantly in operation a few feet below the roof.

South Bend, Ind. JAMES F. HOBART.

METHODS OF STARTING A ROTARY CONVERTER.

There are two general ways of starting a rotary converter, each one having its advantages as well as disadvantages; so perhaps a few words on the relative merits of each will be beneficial to those interested in the operation of these machines. One method of starting is by driving the machine as a shunt-wound direct-current motor and bringing it into synchronism with the alternating-current circuit; the other method is by starting it from the alternating-current side as an induction motor. Under the first method there are two sub-methods. The most common way of starting is as follows: The machine is brought up to speed from the direct-current side as an ordinary direct-current motor. This is done by first closing the field switch, giving the machine a full field from the direct-current bus in the station. Next one terminal of the armature is connected to, say, the positive side of the bus and the other terminal, through a starting box, to the negative bus. The rotary will then turn over and, as the resistance of the starting box is cut out, the machine, of course, comes up to speed. When the rotary is running on full voltage it is ready to be synchronized. It will be seen that it is running "inverted," generating, or, rather, converting, direct current into alternating current and sending this into the secondary of the transformer. This in turn induces a high-voltage current in the primary. Now a synchronoscope is connected across the corresponding phases of the incoming machine and the line from the generating station. This indicates when the rotary and the generator are running in synchronism—that is, at the same speed pole for pole. The speed of the rotary is varied by means of the field excitation until synchronism is attained and at that instant the oil switch connecting the rotary to the line has to be closed. It can readily be seen that if this switch is closed too soon or too late the two currents will "buck" one another, with the result that the rotary's relay will trip the oil switch, and if they are very much out of synchronism the chances are that it will "knock" the generator off, too. In any event, the machine has to be started over again. In the second method of synchronizing, a small induction motor is mounted on the end of the shaft of the rotary. The machine is run by this up to speed. The field switch of the rotary is closed and all of the resistance cut in so that there is hardly any "drag" on the machine. The resistance is then cut out gradually until the rotary slows down and the synchronoscope indicates that they are in synchronism. After the rotary is put on the alternating-current circuit the induction motor is cut out and left to run free on the shaft.

The method of starting from alternating-current side is as follows: Three taps are taken from the secondary of the transformer, giving one-third, two-thirds and full voltage, and are connected to starting switches. After seeing that all the machine switches are open, the high-tension oil switch is closed. Then the first starting switch is closed and the rotary should turn over, running on one-third of its normal voltage. As the machine gathers speed, a voltmeter connected across the direct-current side will oscillate back and forth and finally come to rest in either a reverse or positive position. The field switch (which is a double-throw one) is closed in the normal position if the voltmeter indicates that the machine is generating cur-

rent in the right direction. If, however, it shows that the polarity of the rotary is reversed the field switch is closed in the other position. This reverses the current through the field coils. The polarity of the machine will be reversed and the field switch is pulled out and closed in the normal position. Then the other two starting switches are closed successively, allowing time between the closing of each for the rotary to pick up speed, and when the last one is closed the rotary is running on full voltage and in synchronism and is ready for service.

Now, as to the advantages and disadvantages of these methods. To start by the first method it is, in the first place, essential that there be a storage battery or other source of direct current in the station when the station is shut down. Secondly, it takes time to synchronize and time is of the utmost value when a machine is wanted in a hurry, and it is always when one is in a hurry after a "shut-down" or other trouble that it takes the longest to synchronize a machine, due to low and fluctuating line voltage. The writer has been half an hour trying to synchronize a machine that ordinarily took from one to three minutes. The oldest and most experienced men run the risk of throwing a machine on when it is out of synchronism, through no fault of their own, but because the voltage would vary as they throw the switch, with the result that they have it all to do over again. On the other hand, the rotary starts more smoothly without taking such a rush of current from the generating station. By starting from the induction motor on the shaft there is the advantage of not having to have direct current in the station, regardless of whether or not the station is running, but there is the cost of the motor, and there are still the other disadvantages connected with having to synchronize. By starting from the alternating-current side as an induction motor there is no necessity of having an external source of direct current; the danger of knocking machines off the line by "going-in" out of synchronism is eliminated, and it is much quicker, saving time in an emergency. However, the initial cost of the transformers is slightly more and the machines take a large momentary starting current. In the writer's opinion, the last method is by far the best in the long run, but it is a subject open to debate, as proved by the fact that some large companies stick to the former while others use the latter in all their new stations.

Brooklyn, N. Y. W. R. Sherwood.

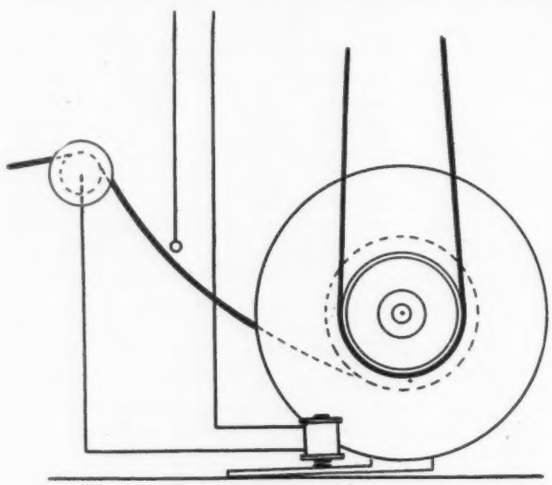
TESTING BLASTING CIRCUITS WITH A FIELD GALVANOMETER.

In preparing to fire large electrically ignited blasts it is important for the powderman to know whether his circuits are closed and in good condition or whether there may be leakage across bare conductors or some of the fuses may have become disconnected. Obviously a blasting circuit all ready to touch off several thousand pounds of powder or dynamite cannot be experimented with under actual working conditions without detonating the whole charge. On the other hand, after all preparations have been made for a blast, the workmen withdrawn and the field cleared, the delay is a serious and often dangerous one if the charge cannot be set off promptly, because if there is tinkering with the circuits, while this is going on some of the workmen, either ignorant or forgetful of their peril, may return to the site of the blast. A large powder-manufacturing concern has recently developed a field type of galvanometer for powdermen's use which can be employed to make sure that all electrical circuits are in good condition and closed before attempting to fire the blast. This outfit employs a source of small current strength which is measured by a sensitive galvanometer arranged to read in ohms the resistance of the circuit traversed. By sending this small current through the blasting circuit, noting the reading of the galvanometer and referring to the accompanying table, which gives the resistances of line wires, fuses, etc., the powderman can easily ascertain if the total reading checks with the number and character of fuses he has set. If so, he can be reasonably sure that the circuit is closed and the lines are in good condition. For example, if the operator has set thirty holes in each of which is an 8-ft. fuse, the resistance reading should be about 33 ohms, and if this is the case he can assure himself that the circuit is complete. If one of the line wires becomes broken or disconnected in tamping the hole, there will be no movement of the galvanometer needle, but the blaster may then, before the blast warning is given, "open-circuit" the series and, taking his galvanometer from hole to hole, readily ascertain the open fuse by testing across the ground terminals. Where possible the separate holes should be independently tested for open wires directly each is tamped in.

Scranton, Pa. John Davis.

WINDING AT UNIFORM TENSION ON A REEL OF VARYING DIAMETER

In the process of making wire mattresses at the factory of the Simmons Manufacturing Company, Kenosha, Wis., the wire links are first made up into the form of a chain which is reeled up and transported to another machine, which cuts this chain into suitable lengths, interconnecting these with cross-links. At the point where the chain is formed, in the first operation, and wound upon wooden reels, similar to those on which electrical wire is shipped, it became a problem to wind the chain properly on the varying circumference of the reels, which continually increased as more chain was wound. The chain was produced at a constant speed in the machine, but, as the diameter of the reel grew, the same reel speed of rotation which



Electromagnetically Controlled Brake.

was proper in the beginning became too fast with the larger circumferences and trouble was caused. To correct this difficulty Mr. W. W. Vincent, general superintendent of the company, arranged the electromagnetically controlled brake shown in the accompanying sketch, which is used in conjunction with a friction-drive clutch on the belt wheel. The pulley speed is adjusted so as to drive the reel, through the friction clutch, at a speed just a little higher than that necessary to reel up the output of the machine on the bare spool. If the chain becomes tightened beyond the slack allowed, contact is made with a metal ring above the chain and a circuit is completed through the electromagnet applying the brake to the reel and allowing the driving pulley to slip a partial revolution until the chain machine catches up and supplies the slack required. The actual rotation of the spool is thus at a varying speed, decreasing as the reel diameter increases and so adjusted at all times that the chain is wound at a constant tension. The principle involved is one that can be applied to advantage in many other forms of reeling operations where it is necessary to wind at even tension a product that is being delivered at a constant rate of production.

Milwaukee, Wis. George Taylor.

QUESTIONS AND ANSWERS

I have a 110-volt, 60-cycle, four-pole fan motor which runs very hot, but the rotor does not run hot when driving another fan of similar design. The bars of the faulty rotor are properly connected to the rings, the rotor does not strike the pole pieces, the field coils show no defect and although new bearings have been inserted and the rotor centered, the trouble still continues. What should cause this? G. H. P.

The fact that the fan motor operates without heating when driving a certain fan, although it heats considerably when driving a different fan, shows at once that the heating is due to the fan, rather than to any defect in the motor itself. It is extremely probable that when the motor overheats it is driving a fan designed for a very much lower rotative speed than that at which the motor operates.

Is there any possible danger of fire in running high-tension wires through switchboard marble in a stone pump house and placing the transformer on a brick shelf within the structure? It is desired to make such an installation in rough country subject to terrific ice storms in winter and excessive heat in summer. J. W. H.

It is perfectly proper to place the transformers for a pump motor on a brick shelf erected within the pump house. The high-tension wires could well be brought through switch marble, and if proper precautions are taken to keep the high-tension wires separated at about the same distance as is used on the external transmission line, the arrangement should give thoroughly satisfactory results. No trouble whatsoever should be expected from fire.

Where half a dozen 220-volt grounded circuits cross the white plastered ceiling of a comparatively new building, I recently noticed that the static dust mark along one of the wires is several times darker than the marking under the other wires of the same polarity. These circuits are all under potential continuously, as the switches are at the other ends of the runs, near the lamps or motors they control. Upon tracing out the excessively blackened circuit, I found it to lead to a motor, which is controlled, however, from a switch on the same side of the marked ceiling. Of course, the current taken by the motor is greater than that of the lighting circuits, but, assuming that the potential and the time during which the wires are charged are the same for all the circuits, which is the case, I cannot understand why all the dust markings should not be similar, for the marks are presumably static effects and so bear no relation to the currents flowing. K. D. L.

If, as you say, all the wires are charged at the same potential during equal periods daily, the darker marking under the underground wire of the motor circuit is doubtless due to the heating effect of the larger current flowing in this circuit. The heat thus produced might cause convection currents in the air, and also increase the adhesiveness of the wall coating, in either case affecting the amount of dust deposited on the wall over this particular wire.

Will you kindly inform me whether, in commercial practice, telephone cables are laid under water in contact with electric transmission cables carrying 2000 volts or more? R. C. M.

Presuming that you refer to incorporating the telephone wires inside the transmission cable in a way similar to that in which pressure wires are sometimes brought back from distribution points, this has sometimes been done. We call to mind an installation on the Pacific Coast where a submarine cable was used some years ago for supplying energy to a motor-driven dredge and through which communication was maintained with the shore. In this case there was no interference or inductive effect. The objection to such an arrangement would be the possible breaking down of the insulation, whereby the higher voltage would be impressed on the telephone line. Any danger to life, however, could be prevented by the use of the insulated telephonic transformer or repeating coil which has been brought out within a year or so. Such a transformer could be inserted in the telephone line between the cable and the telephone user and would protect against shock. With such a highly insulated repeating coil it is probable that the practice of inserting telephone wires in transmission cables will be followed to a greater extent than in the past. Formerly it was the practice to wrap telephone pairs in a separate cable, with steel wires to take the tensional stresses, and to place the cable thus formed alongside the transmission cable. There is, of course, no objection to placing power and telephone cables very close together under water which provides a good ground, as in some of the large cities the distribution companies have their own telephone service installed in the same ducts as the high-tension lines.

I desire to construct a dimmer for theatrical purposes and to employ a choke coil for this purpose. Could you advise me what size of wire, number of turns, length and amount of iron are needed to produce this effect. One dimmer is required to control twenty 16-cp lamps and another to control 140 16-cp lamps, the lamps being rated at 3.5 watts per candle, the circuit potential being 110 volts, and the frequency 60 cycles. It is also desired to construct an auto-transformer giving about 45 amp for a hand-controlled arc lamp using the same circuit. C. H. G.

An auto-transformer designed for operating at an e.m.f. of 110 volts at 60 cycles should have such a sized core and such a number of turns of wire that the product of the core area in square inches and the number of turns of wire in series equals 1100. An auto-transformer of this kind intended to deliver 45 amp at, say, 55 volts should be wound with No. 7 copper wire. All of the turns on this auto-transformer should be connected in series as though to make a single coil, and this single coil should be tapped at its center. However, the two halves of the coil should be placed as close together as possible. A good arrangement would be to have one-half of the coil surround completely the other half. A dimmer of the choke-coil type to be used for theatrical purposes can be constructed much along the lines of an ordinary transformer, the one difference being that some means must be provided for removing the core from the transformer coils. A 110-volt, 60-cycle dimmer should be so arranged that the product of the number of turns of wire by the core area in sq. in. equals about 1000. A dimmer for twenty 60-watt lamps should be wound with No. 10 wire; a dimmer for 140 60-watt lamps should be wound with No. 2 wire.

An old 2200-volt, two-phase motor, having 108 coils, twelve poles, four and five coils per group, connected in series and having 40.75 volts per coil, was changed to operate on a 500-volt, three-phase circuit. Three coils were connected per group per phase per pole, giving thirty-six coils per phase. Twelve coils were then connected in series, or three multiple sets per phase, making the machine a 469-volt motor when connected in delta. The motor heated up considerably, took an abnormally heavy current and ran at only about one-third normal speed. When star-connected with three star groups in multiple, the current taken was not so heavy; but no other change was noted. A delta connection was finally obtained which worked. The machine is a 100-hp motor with a frame large enough to give 200 hp. It has at least 3/32 in. clearance for the rotor and takes 40 amp. at 550 volts running light. Why should the motor require so much power at no load? C. L. H.

The 2200-volt, two-phase motor which you have attempted to rewind as a 500-volt, three-phase motor, seeming, in fact, to have succeeded in so doing, has been connected by you as a six-phase machine. That is to say, the three-phase machine has three separate phase coils per pair of poles, while the winding arrangement used by you has three separate phase groups per coil. In a six-phase winding the adjacent groups differ in time-phase by 60 deg., while in true three-phase winding the difference in time-phase is 120 deg. In order to operate a six-phase machine as a three-phase machine it is necessary to interconnect the three phases as though the first winding were used, the second one skipped initially, the third one inserted in place of the second and the second then reversed and inserted in place of the third. By this means winding A would have zero phase displacement, winding C 120 deg. phase displacement, and winding B 180 deg. + 60 deg. phase displacement, which is, of course, equal to + 240 deg. The machine as rewound by you could best be operated at 489 volts as determined by you. At 550 volts the exciting current would be increased almost in the ratio of 550 to 489. It does not seem that under these conditions 40 amp is greater than one would expect. However, the magnetization at 550 volts would obviously be greater in the same ratio, and it is very probable that the iron portion of the machine will become warmer than was originally intended, although the copper portion will be considerably cooled under load.

Central Station

Management, Policies and Commercial Methods

NEW ENGLAND N. E. L. A. SECTION ACTIVE.

The headquarters office of the New England Section of the N. E. L. A. is actively engaged in collecting statistics upon the subject of central-station rates in New England, in anticipation of the full treatment of this topic, which is planned for the annual meeting in March, 1911. At the New London convention of the section in September the importance of the rate question was emphasized by President A. J. Campbell and several of the speakers, and in view of the great differences in practice noted among the companies in informal discussions of the subject, it was seen that it would be desirable to devote a considerable part of a meeting to the question. The section secretary, Miss O. A. Bursiel, is also collecting data upon operation and is endeavoring to secure copies of electric sign ordinances. Interest is being aroused in connection with the Question Box of the association by the direction of a few questions from each issue to companies specially qualified to make answers. Copies of the "Solicitors' Handbook" and the "Classification of Accounts" recommended by the association are on sale at the office, which is located in the Boston Edison Company's building, 39 Boylston Street, Boston. The membership of the section on Oct. 1 was 713.

INFORMAL EDISON LUNCHEON CLUB AT BOSTON.

For several weeks the plan has been in operation by the Edison Electric Illuminating Company of Boston of assembling the heads of departments and bureaus informally for luncheon at a restaurant near the company's headquarters building on Boylston Street. The gathering takes place between the hours of noon and 2 p. m. five days a week, and it affords an opportunity for personal intercourse and the discussion of matters of company interest which is often lacking in the hours when the officials are scattered over the system. Special agents are also included in the party. During the luncheon hours the telephone operators of the company are in constant touch with the persons in the gathering, and it has been found that in addition to the interchange of ideas and informal good-fellowship aroused the making of appointments has been greatly facilitated and considerable time saved in the transaction of business. The general arrangements are in the hands of a committee headed by Mr. R. S. Hale, the other members being Messrs. C. H. Crockett, J. C. Redmond, W. H. Cole and Daniel Goss. From fifty to sixty men frequently assemble under this plan.

CENTRAL-STATION RESULTS AT LOWELL, MASS.

The return of the Lowell Electric Light Corporation to the Massachusetts Gas & Electric Light Commission for the year ended June 30, 1910, shows a substantial increase in earnings over the previous year. The total revenue of the company for 1910 was $395,298, compared with $348,291 in 1909, or a gain of 13.5 per cent. It is significant that the earnings of the company from the sale of electric power exceeded those of any other department by about $10,000, whereas last year the largest single item of earnings was commercial lighting, which exceeded the power sales in 1909 by $20,000. The total revenue from the sale of power in 1910 was $160,589, a gain of 29 per cent over the preceding year. The commercial lighting income of the company increased from $144,014 in 1909 to $150,214 in the later year. The street lighting income gained about $1,000 in 1910, the total from this source being $17,795.

The principal items of operating expense for the year totaled $253,346, compared with $235,503 in 1909. These expenses included cost of manufacture, distribution expense, office expenses and management, taxes, legal, insurance, and other miscellaneous expenses. There was thus a gain in net earnings after the above items had been deducted of $29,000. The company's total output at the switchboard during the year was 12,986,367 kw-hours, and of this output 8,529,620 kw-hours were sold to commercial customers. The sales of energy for lighting the streets totaled 1,272,843 kw-hours; for lighting by meter, 1,893,568 kw-hours; for contract lighting, estimate, 300,000 kw-hours; and for electric motor service, 6,336,052 kw-hours. The company used in its own service 212,423 kw-hours. The average income per kw-hour sold was about 4.63 cents, and the average income per kw-hour of power sales was practically 2.5 cents. The company burned during the year 18,066 tons of coal at an average cost of about $4.21 per ton.

ELECTRIC LIGHTING IMPROVEMENTS AT FORT WORTH, TEX.

The recent purchase by Mr. J. R. Nutt, of Cleveland, Ohio, of the electrical franchise and other holdings of the Fort Worth Light & Power Company and the electric properties of the Fort Worth Gas Company was accompanied by an arrangement with the city government which provides for the immediate construction of a central hydroelectric plant on the Trinity River with a capacity of 22,000 hp and other large improvements which call for a total expenditure of approximately $2,000,000.

It is stipulated in the contract, which the City Commission has ratified, that the price for electric lighting current in Fort Worth under the proposed merger shall be 10 cents per kw-hour on a basis of 2 kw use per hour, and 6 cents per kw-hour for any excess of this use. It is stated that the effect of this contract will be to reduce the rate that is now being paid by consumers one-half. It is further provided that the city shall reserve the municipal lighting plant and may use it as it sees fit. The city is granted a rate of 4 cents per kw-hour for the fire district and business streets and 3½ cents for city lights in the residence districts, under the provisions of Mr. Nutt's contract. All the wires in the business part of town will be put underground. Mr. Nutt agrees to install an elaborate system of street illumination at an estimated cost of $78,000, which shall become the property of the city upon its completion. The proposed system will include tungsten lamps.

It is planned that power from the proposed central hydroelectric plant shall be sold for operating the local electric railway system, the Northern Texas Traction Company's line between Fort Worth and Dallas, the machinery of the two large meat-packing plants in North Fort Worth and other industries of the city and adjacent territory.

The plans submitted by Charles William Ricker, an electrical engineer who represented Mr. Nutt in the transaction, were formally approved by the City Commission. Mr. Nutt is managing director of the Citizens' Saving & Trust Company, of Cleveland, Ohio.

NEW YORK CITY ELECTRICAL CODE.

The following changes have been made in the electrical rules and regulations of the Department of Water Supply, Gas and Electricity of New York City, Bureau of Electrical Inspection.

Beginning Nov. 1, 1910, the first paragraph of Rule 21-e, which reads as follows: "The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given

in No. 16," will be eliminated and the following inserted in its place: "Except in cases where Rule 21-d applies correct fusing will be deemed to have been secured when a fuse of the nearest standard rating to the ampere capacity of the wire as given in No. 16 is employed."

Beginning the same date the present sign rules as contained in the list of fittings of the Underwriters' National Electrical Association will be withdrawn and the following, to be known as Rule 12-d, will be substituted therefor:

a. Wires carried on the outside of sign structures must be run in approved metal conduit or approved armored cable. This does not apply to signs erected on roofs or on open ground where rubber-covered wire is employed and is not subject to mechanical injury and where it is kept at least 1 in. from the surface wired over.

b. Wires within the structure of a sign must be double-braided rubber-covered, and where the difference of potential between wires is over 120 volts, they must be separated by at least ½ in.

c. Must be constructed entirely of metal.

d. Sheet metal must not be less than No. 26 gage.

e. Must be braced by angle iron of such thickness and so placed as to secure sufficient strength and rigidity.

f. All metal must be galvanized or enameled or treated with at least three coats of anti-corrosive paint or compound.

g. If the terminals of receptacles are not of the enclosed type receptacles must be so constructed that the terminals will be at least 1 in. from the surface wired over. Wires must be soldered to terminals and exposed parts must be treated to prevent corrosion.

h. All signs must be made weatherproof and each compartment must have suitable provision for drainage.

i. Where wires pass out of letters or into cut-out box they must be protected by approved tubes or bushings.

j. Where wire not inferior in size and insulation to approved No. 14 gage rubber-covered wire is used connecting direct to standard sockets or receptacles 1320 watts may be dependent upon the final cut-out.

k. Must have maker's name or trade mark permanently attached to the exterior.

l. Must be so constructed as to render each compartment accessible for inspection, or in lieu thereof must be inspected and labeled at the factory.

CO-OPERATIVE INDUSTRIAL DEVELOPMENT AT BOSTON.

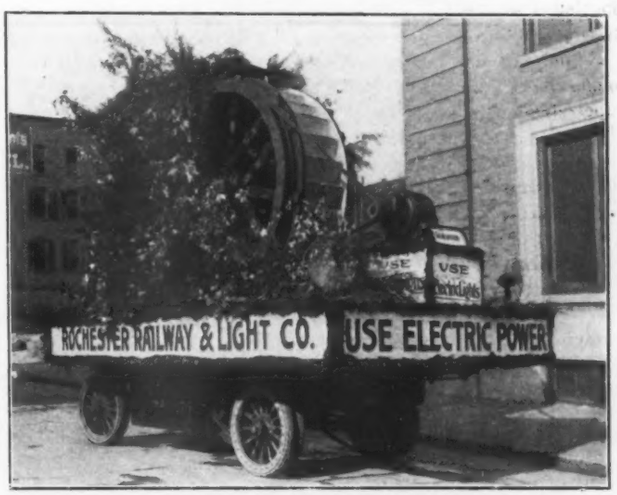
During the past few months the Edison Electric Illuminating Company of Boston has been engaged in a campaign for furthering the industrial development of the thirty-four cities and towns in which it operates, the plan being a co-operative one by which a committee of the company works with committees of two members each from the various municipalities to locate factories, residences and stores in the various communities engaged in the movement. The campaign is an outgrowth of the electrical show held in Boston last year, when special efforts were made by the company to enter into closer relations with the residents of its territory. The town committees were appointed by the local boards of trade, improvement associations, or in some cases by regular town meetings. The committee from the Edison company consists of W. H. Lott, chairman; L. D. Gibbs, secretary, and L. R. Wallis, superintendent of the sales department, third member. At the outset of the campaign a general meeting of the committees was held in the company's assembly hall in Boston and after a discussion of the plans a dinner was served.

At the meeting Mr. W. H. Atkins, general superintendent of the company, addressed the gathering, referring to the interest of the company in the progress of all the communities which it serves, and pointing out the advantages of Boston and its suburbs as locations for industrial enterprises and homes. He touched upon the reliability and economy of the company's lighting and power service, the uniformity of the rates throughout its territory of about 500 square miles, and the benefits of electric power in relation to the maintenance of healthy and attractive conditions of living. He criticised offers of financial assistance as means of attracting business enterprises to towns and pointed out the superiority of good shipping facilities, water supply, roads and sanitary conditions.

The company has made arrangements with various municipalities for the installation of large electrically lighted billboards calling attention to the advantages of the specific municipality as an industrial point of location. Each of these signs is 50 ft. long and 10 ft. high and bears the name of the town, its distance from Boston, the economy of electric power compared with steam and water, with the address of the co-operative development committee. The Edison company erects and equips the signs with lamps and hood reflector and lights them free of charge from dark to midnight six days per week as its contribution to the industrial publicity of the town. At present these signs offer no expense whatever to any town using them, and public-spirited citizens have in every case been willing to give a lease of the land free of charge. The Edison company's name does not appear on any of the signs. In each case the lease provides that the wording of the sign shall be under the control of the local committee. The signs are located so far as possible in conspicuous places where they will be easily seen from passing steam railroad trains and trolley cars by automobile tourists and other travelers.

CENTRAL-STATION FLOAT IN ROCHESTER INDUSTRIAL PARADE.

The accompanying illustration shows a storage-battery truck used by the Rochester Railway & Light Company, of Rochester,



Float in Rochester Industrial Exposition.

N. Y., in the industrial parade constituting part of the Rochester Industrial Exposition held during two weeks beginning Oct. 17. The float consisted of a very large slow-moving waterwheel driving a small generator. Under the bows of autumnal foliage which surrounded part of the wheel was concealed a triplex pump, motor-driven from the truck batteries. This pump delivered water from a 200-gal. tank to a weir at the top of the waterwheel; the water then descended, driving the overshot wheel, and was re-collected in the tank. The signs were outlined in green moss, carrying out the more or less rustic effect of the banking about the wheel. The wheel operated continuously throughout the parade, and subsequently was run all afternoon in front of the company's offices on Clinton Street, where it attracted considerable attention. Two electric fans apparently driven by the "generator" added a touch of realism to the float. The parade was held on Oct. 18.

During the exposition, which was the third given in the Flower City, the main streets of the city were attractively illuminated. Immense canopies located at the intersections of the principal thoroughfares on Main and State Streets and lighted by over 1050 lamps each were suspended at least 60 ft. above the roadway. The spectacular lighting did not vary in essential details from that given last year and described in detail in these pages at the time. The Rochester Railway & Light Company with its enthusiastic aggressiveness for all that helps Rochester furnished all of the spectacular illumination free of charge.

SMALL PLANT FAILURES AND A CAUSE FOR THEM.

By Charles T. Johnson.

Electric light plants in towns of less than four or five thousand people seem, as a class, to have acquired an unsavory reputation with bond houses and investment companies in general. Application for funds by these small plants usually brings the reply that the investing company deals only with properties having a gross revenue of more than $30,000 or $50,000 per year.

Investigation into the past history of the small companies shows the principal cause for their bad financial reputation to be lack of appreciation by the owners, usually business men in the small town, of the requisites of a good electric plant manager. In many instances the owners seem to have regarded a man's ability to run an engine and to string wires in houses as the determining requirements of a manager or superintendent. The position appears to be worth not more than $60 or $70 per month. As a result, many plants have been subjected to a $60 per month quality of management and are much the worse for it. The net earnings were not such as to encourage the stockholders to put in additional investment to take care of increasing demand or to replace obsolete machinery, and consequently the finances of the company got into a worse, instead of a better, shape.

In not a few instances all of the difficulties of small companies can be traced to cheap and inefficient management. The superintendent of a small plant should be a broad-minded, diplomatic and technically trained man. His services should be worth at least $100 per month. A man that is not worth this amount is not of the type to be put in charge of an investment of $15,000 and upward. He should be capable of taking the place of any one of his employees in cases of emergency and should be willing and able to work thirty-six hours at a time if occasion require it. He should also be a man with a pleasing personality and one capable of getting into, and staying in, the good graces of the town board or city council. He should have enough technical knowledge to enable him to know when his plant is being operated economically, to test meters, to figure line losses and to take care of the many problems he meets which require for their solution a working knowledge of practical electrical engineering.

When the necessary money is put at the disposal of a superintendent of this caliber he can, in almost every case, turn a losing proposition into a paying one. Practically all of the well-managed plants in small towns are on a good financial basis, and it is safe to assume that the right man is not in charge, or the man is not supplied with sufficient money to get the plant started right, when we see a losing one.

CAPABLE ELECTRICIANS FOR SMALL PLANTS.

While the larger electric corporations appreciate and realize the importance of putting the best men obtainable at the heads of departments the managers of light plants in smaller towns are too much inclined to let a few dollars per month in wages stand in the way of getting good, capable men in their employ. The plant in a town of 4000 people and under usually has an electrician who acts as a general utility man, wiring houses, constructing lines, reading meters, trimming lamps and taking care of all trouble that way. He is continually on the street and in contact with the people and is very frequently the real representative of the corporation. The position calls for a strong, capable, wideawake man, yet those in authority sometimes consider it a $50 per month job and put any one into it that can be obtained for this amount.

The man to be got at this price is too frequently one of local origin, who has picked up in a desultory way enough knowledge to enable him to wire houses so that lamps will burn, to read meters accurately if some of the hands are not near a 9 or 0 point, and to find new business when it is thrust upon him. The salary and the prospects of a raise are not great enough to put any life and energy into him.

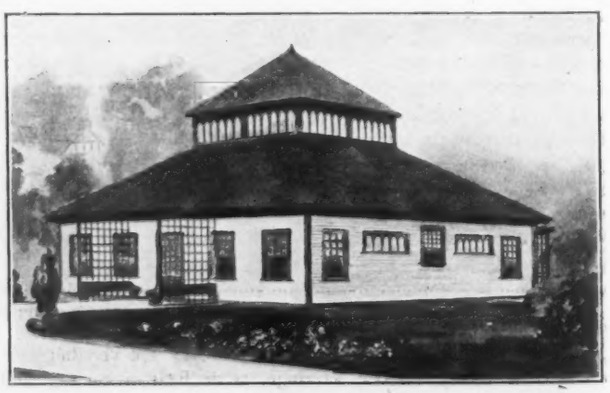
In the average small town where living is low a salary of $70 or $80 per month will usually attract a capable, wideawake and experienced man. The management may look upon this additional $20 or $30 per month as a questionable investment, but it is safe to say that it would be a profitable and wise undertaking.

In the matter of wiring houses alone all of this investment may be got back. More time can be fooled away by an incapable man in stringing a few wires in a building than a person who has not observed the difference in the way men work could possibly imagine. The man who has qualified as a wireman by helping another incapable electrician wire a few houses will consume more time in planning his circuits than the experienced wireman will expend in completing the job. And after the would-be wireman has finished his work it wouldn't be safe to submit it to underwriters' inspection. As a meter reader the cheap, careless man is very expensive. Mistakes, of course, are always rectified by the next month's reading, but every mistake increases the suspicions of an already incredulous public as regards accuracy of meters in general, and these suspicions frequently cause no end of trouble and inconvenience.

But the great value of a capable all-round electrician is his ability to be a constant "new-business" solicitor. When called out to fix a defective socket or insert a fuse he has the best opportunity to talk electric iron, fan or porch light to the customer. A few calls for miscellaneous purposes will usually put the tactful electrician on such a footing with the members of the family that he can do more toward increasing the sale of electricity in that house or in homes in the neighborhood than even a new-business solicitor well versed in the art of salesmanship.

ELECTRIC HOUSE TO BE EXHIBITED BY BOSTON EDISON COMPANY.

With the object of popularizing electricity for residential service to a larger extent in its territory the Edison Electric Illuminating Company of Boston is now building a portable bungalow which will be exhibited in all the principal cities



Portable Electric House.

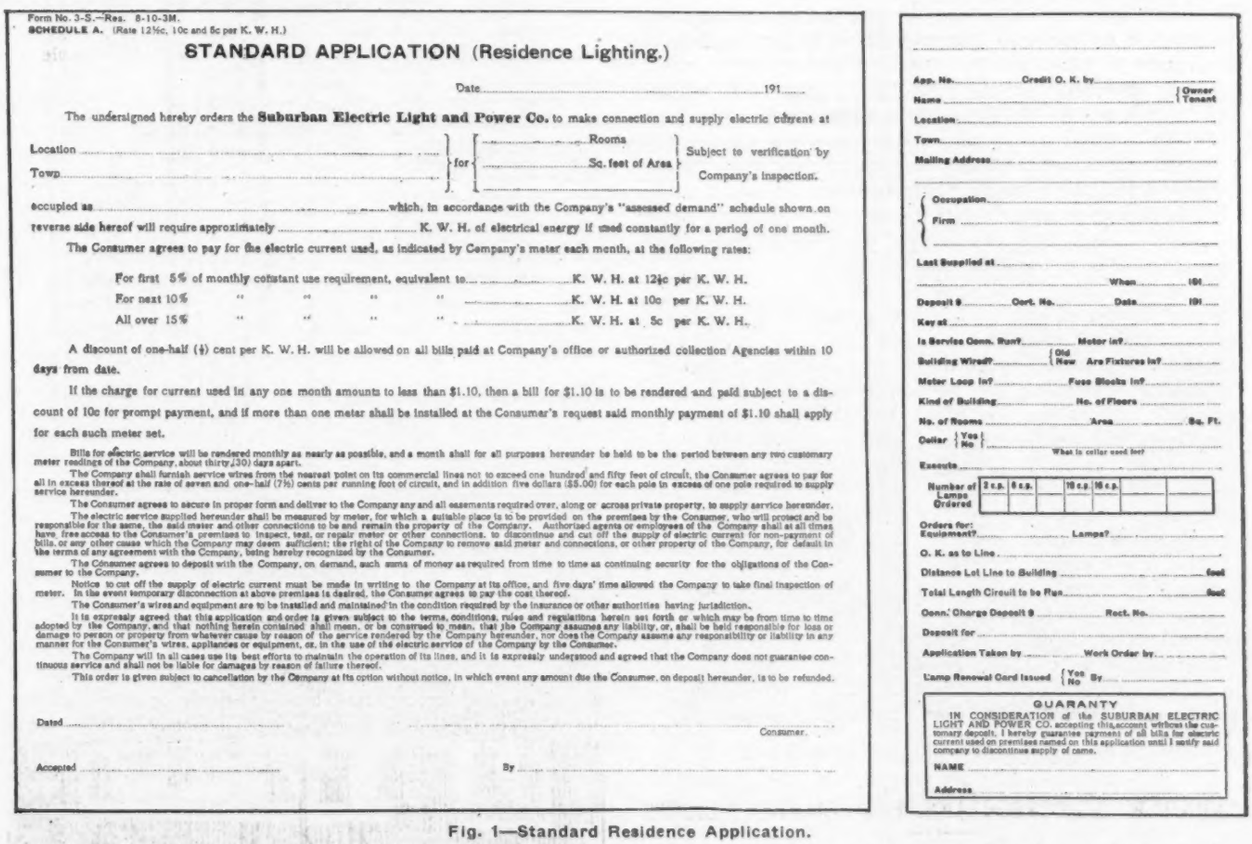
and towns in which the company operates. The present plan contemplates placing the house in a municipality for a season, Winchester being selected as the first town to be visited. The house will be equipped with a great variety of electrically operated conveniences which are now available for use in any home, and only the practical devices which tend to increase the real comfort and convenience of home life will be shown. The house when completed will be 34 ft. square with an 8-ft. x 10-ft. pergola on the front and rear. An entrance hall 10 ft. long x 6 ft. wide is provided, from which double doors on either side open into a dining-room on the right and a living-room on the left. At the end of the hall will be a spacious reception room surmounted by a dome, and beyond the reception room will be a hall similar to that in front flanked by a kitchen on one side and a chamber on the other. A bathroom and pantry will also be provided. Special effort will be made to avoid the installation of so-called novelties which tend only to increase the size of the customer's bill and give no adequate return, either in enjoyment or convenience. The house will be carefully furnished according to the best modern standards of taste, and it will be placed in the general charge of a man well known in each town to which it goes. It is planned to have the house open all day and throughout the evening, and a force of competent demonstrators will be on hand to help visitors make the most of the establishment. Among the possibilities is a so-called "maids' night," when the benefits of electricity will be brought home to domestic servants in representative families. An electrically driven refrigerating plant supplied on the basis of a flat rate per month for off-peak service will be a feature of the equipment, and the house will be provided with a modern electric garage and charging station, equipped with mercury arc rectifier outfit and a Bailey electric carriage, with Edison battery and motor-driven tire pump. It is anticipated that the hospitalities of the company at the house will make it an attractive place socially. The house is designed so that it may easily be taken down in sections and shipped to other points when its visit to any given municipality terminates.

CENTRAL-STATION RATE SCHEDULES FOR RETAIL CUSTOMERS.

By A. C. EINSTEIN.

ELECTRIC companies in recent years have experienced much difficulty in their relations with consumers to establish a basis upon which an equitable schedule of rates can be established—some method which will accord the liberal patron and long-hour user of electrical energy for a like requirement a rate proportionate to his value as a customer as compared to the user who draws on the company sparingly and in particular only during the hour of peak loads. It has been the practice for electric companies to charge an established rate for the general run of customers, with a discount, or scale of discounts, on the monthly bill proportionate to the gross amount. This results to the advantage of the customer with a large installation, who pays less per unit of energy used than the "little fellow" even though the consumption of the latter proportionate to his connected load should fairly entitle him to an equal or lower rate per unit.

To overcome this apparent unfairness a method has come into vogue to charge for the energy used on an "hours'-use" schedule based either on the connected load or the demand. This method has the advantage that the electric company then receives for the use of its service during the peak hour the full rate and an adequate return; and it automatically insures to the user a reduced rate for long hours' use. For the customer with a large installation, indicators or other measuring devices are installed to ascertain the demand or maximum rate at which energy is used. For the general run of customers, the masses patronizing the electric company, devices to record the demand are not only an additional expense requiring extra labor and time to read and record such readings, but are a burden which from an investment standpoint the companies in large cities, and more particularly those in the smaller towns, do not wish to incur. To avoid the installation of such indicators or measuring devices many electric companies have resorted to the expedient of basing the hours'-



Form No. 3-S.—Res. 8-10-3M.
SCHEDULE A. (Rate 12½c, 10c and 5c per K. W. H.)

STANDARD APPLICATION (Residence Lighting.)

Date ..... 191....

The undersigned hereby orders the **Suburban Electric Light and Power Co.** to make connection and supply electric current at

Location ..... Town ..... } for { ..... Rooms / ..... Sq. feet of Area } Subject to verification by Company's inspection.

occupied as ..... which, in accordance with the Company's "assessed demand" schedule shown on reverse side hereof will require approximately ..... K. W. H. of electrical energy if used constantly for a period of one month.

The Consumer agrees to pay for the electric current used, as indicated by Company's meter each month, at the following rates:

For first 5% of monthly constant use requirement, equivalent to ..... K. W. H. at 12½c per K. W. H.
For next 10% " " " " ..... K. W. H. at 10c per K. W. H.
All over 15% " " " " ..... K. W. H. at 5c per K. W. H.

A discount of one-half (½) cent per K. W. H. will be allowed on all bills paid at Company's office or authorized collection Agencies within 10 days from date.

If the charge for current used in any one month amounts to less than $1.10, then a bill for $1.10 is to be rendered and paid subject to a discount of 10c for prompt payment, and if more than one meter shall be installed at the Consumer's request said monthly payment of $1.10 shall apply for each such meter set.

Bills for electric service will be rendered monthly as nearly as possible, and a month shall for all purposes hereunder be held to be the period between any two customary meter readings of the Company, about thirty (30) days apart.

The Company shall furnish service wires from the nearest point on its commercial lines not to exceed one hundred and fifty feet of circuit, the Consumer agrees to pay for all in excess thereof at the rate of seven and one-half (7½) cents per running foot of circuit, and in addition five dollars ($5.00) for each pole in excess of one pole required to supply service hereunder.

The Consumer agrees to secure in proper form and deliver to the Company any and all easements required over, along or across private property, to supply service hereunder.

The electric service supplied hereunder shall be measured by meter, for which a suitable place is to be provided on the premises by the Consumer, who will protect and be responsible for the same, the said meter and other connections to be and remain the property of the Company. Authorized agents or employees of the Company shall at all times have free access to the Consumer's premises to inspect, test, or repair meter or other connections, to discontinue and cut off the supply of electric current for non-payment of bills, or any other cause which the Company may deem sufficient; the right of the Company to remove said meter and connections, or other property of the Company, for default in the terms of any agreement with the Company, being hereby recognized by the Consumer.

The Consumer agrees to deposit with the Company, on demand, such sums of money as required from time to time as continuing security for the obligations of the Consumer to the Company.

Notice to cut off the supply of electric current must be made in writing to the Company at its office, and five days' time allowed the Company to take final inspection of meter. In the event temporary disconnection at above premises is desired, the Consumer agrees to pay the cost thereof.

The Consumer's wires and equipment are to be installed and maintained in the condition required by the insurance or other authorities having jurisdiction.

It is expressly agreed that this application and order is given subject to the terms, conditions, rules and regulations herein set forth or which may be from time to time adopted by the Company, and that nothing herein contained shall mean, or be construed to mean, that the Company assumes any liability, or, shall be held responsible for loss or damage to person or property from whatever cause by reason of the service rendered by the Company hereunder, nor does the Company assume any responsibility or liability in any manner for the Consumer's wires, appliances or equipment, or, in the use of the electric service of the Company by the Consumer.

The Company will in all cases use its best efforts to maintain the operation of its lines, and it is expressly understood and agreed that the Company does not guarantee continuous service and shall not be liable for damages by reason of failure thereof.

This order is given subject to cancellation by the Company at its option without notice, in which event any amount due the Consumer, on deposit hereunder, is to be refunded.

Dated ..... Consumer.

Accepted ..... By .....

App. No. ..... Credit O. K. by .....
Name ..... { Owner / Tenant }
Location .....
Town .....
Mailing Address .....
{ Occupation ..... / Firm ..... }
Last Supplied at ..... When ..... 191....
Deposit $ ..... Cert. No. ..... Date ..... 191....
Key at .....
Is Service Conn. Run? ..... Motor in? .....
Building Wired? ..... { Old / New } Are Fixtures in? .....
Meter Loop in? ..... Fuse Blocks in? .....
Kind of Building ..... No. of Floors .....
No. of Rooms ..... Area ..... Sq. Ft.
Cellar { Yes / No } ..... What is cellar used for?
Execute .....

Number of Lamps Ordered	2 c.p.	6 c.p.		10 c.p.	16 c.p.		

Orders for: Equipment? ..... Lamps? .....
O. K. as to Line .....
Distance Lot Line to Building ..... feet
Total Length Circuit to be Run ..... feet
Conn. Charge Deposit $ ..... Rect. No. .....
Deposit for .....
Application Taken by ..... Work Order by .....
Lamp Renewal Cord Issued { Yes / No } By .....

GUARANTY

IN CONSIDERATION of the SUBURBAN ELECTRIC LIGHT AND POWER CO. accepting this account without the customary deposit, I hereby guarantee payment of all bills for electric current used on premises named on this application until I notify said company to discontinue supply of same.

NAME .....
Address .....

Fig. 1—Standard Residence Application.

use charge on the connected load or a percentage thereof. This practice has many objections, some of which are as follows:

A consumer who, for convenience or decorative effect, is liberal in his installation will be charged on a large connected load unfairly for his hours' use as compared with a patron who wires up his premises with the least possible number of outlets. Although the premises of these consumers may be alike in size and the former use a greater amount of electrical energy, still it is possible for the latter, under an hours'-use schedule based on connected load, to obtain his energy at an average less rate per unit. This seems eminently unfair, and the basis on which the schedule of rates is applied contributes to its unfairness. Charging by the hours'-use schedule of rates based on connected load also places a restriction on the business of the electric company, for the reason that it encourages or compels the consumer to limit his connected load to his actual requirements in order to reach through the hours'-use schedule a possible lower rate for energy consumed.

hours'-use rates, based on connected load, the writer has concluded, irrespective of the actual capacity connected, to establish in lieu of the actual connected load a fixed charge or "assessed demand" per room for residence lighting, and a fixed charge or "assessed demand" per 100 sq. ft. of area for commercial or general lighting. By this method each consumer is treated alike; if one chooses to make a liberal installation he will not suffer thereby, but may secure through liberal consumption the average lower rate to which he may be entitled.

For residence lighting the fixed charge, or, as it should be called, "assessed demand," is as follows: For the first 3 rooms, 100 watts per room; for the next 4 rooms, 60 watts per room; for the next five rooms, 40 watts per room; for the next 6 rooms, 35 watts per room; for the next 7 rooms, 30 watts per room, and all over 25 rooms, 25 watts per room. For stores or commercial purposes, and rooms in excess of 500 sq. ft. in area, the following fixed charge or "assessed demand" schedule has been adopted: For the first 1000 sq. ft. area, 30 watts per 100

Form 4. Contract Lighting. 1M-8-10.
CONTRACT SERVICE Schedule B. (Yearly contract 1 K. W. or more.)

CONTRACT FOR ELECTRIC LIGHT.

Agreement entered into this ..... day of ..... 19..... between the **Surburban Electric Light and Power Co.,** hereinafter called the Company, and .....

..... hereinafter called the Consumer.

In consideration of the premises and the mutual covenants herein contained the parties hereto agree with each other as follows:

The Company agrees to supply and the Consumer agrees to take from the Company such electricity as shall be required by the Consumer for light on the premises at ..... Town .....

St. Louis County, Missouri, for the period of ..... year , beginning ..... 19..... and ending ..... 19....., and thereafter, until thirty (30) days' notice shall be given in writing by either party of a desire to discontinue the service.

The Consumer agrees to pay the Company each month in accordance with the Company's assessed demand schedule shown on reverse side hereof at the following rates:

MONTHLY FIRST CHARGE.

For the first 10 K. W.	Assessed demand or Maximum demand	$4.20 per K. W. per Month
For the next 20 K. W.		$3.65 per K. W. per Month
For the next 70 K. W.		$3.15 per K. W. per Month
For all over 100 K. W.		$2.65 per K. W. per Month

MONTHLY SECOND CHARGE.

In addition to the foregoing monthly "First Charge" the consumer agrees to pay for **electric energy used** each month as indicated by meter installed by the Company as follows:

For the first 1000 K. W. H. used at 5c per K. W. H.
For the next 2000 K. W. H. used at 4c per K. W. H.
For the next 7000 K. W. H. used at 3½c per K. W. H.
For all over 10000 K. W. H. used at 3c per K. W. H.

A discount of five (5) per cent will be allowed on all bills paid at Company's office or authorized collection Agencies within 10 days from their date.

The consumer agrees to pay the **monthly minimum,** which amount shall be the equivalent of the demand or monthly First Charge.

Bills for electric service will be rendered monthly as nearly as possible, and a month shall for all purposes hereunder be held to be the period between any two customary meter readings of the Company, about thirty (30) days apart.

The Company shall furnish service wires from the nearest point on its commercial lines not to exceed one hundred and fifty feet of circuit, the Consumer agrees to pay for all in excess thereof at the rate of seven and one-half (7½) cents per running foot of circuit, and in addition five dollars ($5.00) for each pole in excess of one pole required to supply service hereunder.

The Consumer agrees to secure in proper form and deliver to the Company any and all easements required over, along or across private property, to supply service hereunder.

The electric service supplied hereunder shall be measured by meter, for which a suitable place is to be provided on the premises by the Consumer, who will protect and be responsible for the same, the said meter and other connections to be and remain the property of the Company. Authorized agents or employees of the Company shall at all times have free access to the Consumer's premises to inspect, test, or repair meter or other connections, to discontinue and cut off the supply of electric current for non-payment of bills, or any other cause which the Company may deem sufficient: the right of the Company to remove said meter and connections, or other property of the Company, for default in the terms of any agreement with the Company, being hereby recognized by the Consumer.

The Consumer agrees to deposit with the Company, on demand, such sums of money as required from time to time as continuing security for the obligations of the Consumer to the Company.

The Consumer's wires and equipment are to be installed and maintained in the condition required by the insurance or other authorities having jurisdiction.

It is expressly agreed by the Consumer, that this agreement is entered into subject to the terms, conditions, rules and regulations herein set forth or which may be from time to time adopted by the Company, and that nothing herein contained shall mean, or be construed to mean, that the Company assumes any liability, or, shall be held responsible for loss or damage to person or property from whatever cause by reason of the service rendered by the Company hereunder, nor does the Company assume any responsibility or liability in any manner for the Consumer's wires, appliances or equipment, or, in the use of the electric service of the Company by the Consumer.

The Company will in all cases use its best efforts to maintain the operation of its lines, and it is expressly understood and agreed that the Company does not guarantee continuous service and shall not be liable for damages by reason of failure thereof.

This agreement, although signed, is subject to the approval of the Commercial Agent of the Company, and shall not be binding on the Company until endorsed with his approval.

.....

.....

.....

.....

.....

SUBURBAN ELECTRIC LIGHT AND POWER CO.

Approved ..... 19.....

By .....

SUBURBAN ELECTRIC LIGHT AND POWER CO.

By .....
Commercial Agent.

.....
Consumer.

By .....

Assessed Demand for Contract Service Lighting (How Obtained.)

Assessed demand on which within rates shall apply shall be ascertained on area basis, except for rooms containing under 500 sq. ft., which shall be figured on room basis.

(Halls on each floor, Bath Rooms, Toilet Rooms, Butler's Pantry, shall each be counted as one room. Cellar if used for storage purposes shall be figured at 50 Watts; if used for business purposes to be assessed on area basis. Roadways and gardens or places where extent of lighting is nominal if used in connection with interior lighting, 50% of actual wattage of lamps installed shall be figured as the assessed demand, otherwise such service shall be figured on basis of total wattage connected.)

Assessed Demand for Rooms.

For first 3 Rooms 100 Watts per Room
For next 4 Rooms 60 Watts per Room
For next 5 Rooms 40 Watts per Room
For next 7 Rooms 30 Watts per Room
All over 25 Rooms 25 Watts per Room

Assessed Demand for Areas.

For first 1000 sq. ft. 30 Watts for each 100 sq. ft.
For next 2000 sq. ft. 25 Watts for each 100 sq. ft.
For next 3000 sq. ft. 20 Watts for each 100 sq. ft.
All over 6000 sq. ft. 15 Watts for each 100 sq. ft.

NOTICE.—The Company may install indicators or measuring devices to ascertain the demand or maximum rate at which energy is used; such record may, if the Company so elects, be established as, and in lieu of the assessed demand as above provided.

Fig. 2—Standard Lighting Contract.

The connected load is also a variable quantity. A consumer's premises upon inspection may show a certain capacity connected which, without notice to or knowledge of the company, the consumer may increase from time to time. This is not only possible, but has become in the writer's experience a practice. The consumer, knowing the hours'-use schedule of rates applies on his connected load, will, until his premises are inspected, install a connected load temporarily, with the possible intention of increasing it materially after inspection.

In many cases consumers not familiar with the relation between the hours'-use rate and connected load, having made a liberal installation, will, when receiving a bill seemingly high, not only cut down the use of electrical energy, but also in many instances will remove lamps and discontinue the use of other energy-using appliances. Although the actual hours' use of the then connected load may entitle this consumer to a lower rate, he, however, through ignorance of the relation between connected load and hours'-use schedule, does not secure it, as the record of his original installation has not been changed on the books of the company.

To overcome the possible unfairness in the application of

sq. ft.; for the next 2000 sq. ft. area, 25 watts per 100 sq. ft.; for the next 3000 sq. ft. area, 20 watts per 100 sq. ft., and for the next 6000 sq. ft. area, 15 watts per 100 sq. ft. A charge is established for cellars, which in residences are figured as one room, while in stores, if used for business purposes, they are assessed on an area basis. Provision is also made for outdoor or general lighting in connection with residence or store lighting.

It will be noted that the "assessed demand" for residence lighting is based on the number of rooms beginning with three or less at 100 watt capacity each, with proper concession to the subscriber occupying more extended premises, the watts capacity per room or the "assessed demand" decreasing proportionately to the greater number of rooms. By this method subscribers having a like number of rooms will have an established like "assessed demand." There is no discrimination and no restriction to a liberal installation; the more light or electrical energy the consumer uses proportionate to his "assessed demand" the lower the rate.

A point in our application forms is that under the residence lighting form of application the monthly minimum payment required is $1 net, regardless of the "assessed demand." Un-

der the commercial or general lighting form an increased monthly minimum payment charge applies, for the very good reason that the light is used for commercial purposes, and the concessions made determining "assessed demand" justify a higher monthly minimum charge. Under our contract, the company, however, reserves the right to install indicators or measuring devices to ascertain the maximum demand which can be established by the company in lieu of the "assessed demand."

Form. No. S-21. 3M-7-10.

INSPECTOR'S REPORT

VERIFYING CONNECTED LOAD AND ASSESSED DEMAND

Appl. No..... Date of Inspection..... 10.....

Name.....

Location..... Town.....

Occupied as.....

LIGHTING LOAD				POWER LOAD			
No. of Lamps	C.P.	Kind	Watts	No. of Motors	Kind	H.P. Each	Total H. P.

Total Watts Connected..... Total Horse Power Connected.....

Kind of Building.....

.....Room Area..... ft. x..... ft. .....Motor..... H. P.

.....Room Area..... ft. x..... ft. .....Motor..... H. P.

.....Room Area..... ft. x..... ft. .....Motor..... H. P.

.....Room Area..... ft. x..... ft. .....Motor..... H. P.

.....Room Area..... ft. x..... ft.

.....Room Area..... ft. x..... ft.

Cellar? { Yes / No .....

Used for.....

No. Floors?..... No. Rooms?.....

Total..... H. P.

General Lighting..... Lamps..... C.P. Lighting Load connected with motor.

For Roadways, } Lamps..... C.P. .....Lamps..... C. P.
Gardens, Etc. } Lamps..... C.P. .....Lamps..... C. P.

.....Lamps..... C. P.

Remarks:.....

Inspector

Blank spaces below to be filled out by Commercial Department.

Assessed Demand as follows:

For..... Rooms..... Watts .....H. P. @ .....$..... Watts

For..... sq. ft. Area..... Watts .....H. P. @ .....$..... Watts

For..... Lamps connected..... Watts .....H. P. @ .....$..... Watts

For Roadways, Gardens, Etc..... Watts Lighting Load..... Watts

Total..... Watts Total..... Watts

By.....

Blank spaces below to be filled out by Accounting Department.

Constant use..... K. W. H.s.

First 6¢..... K. W. H.s.

Next 10¢..... K. W. H.s.

All over 16¢..... K. W. H.s.

Remarks:.....

By.....

Fig. 3—Inspection Report Card.

Thus far our company's experience has been most satisfactory in its relation with our residence and commercial or retail patrons whom we are serving under the above plan.

Wiring and Illumination

LIGHTING OF THE BURLINGTON ARCADE.

It has been customary in the large department stores of John Wanamaker in New York and Philadelphia to feature the latest styles and the world's treasures gathered by a host of foreign representatives in fashion reviews, expositions, conferences, etc., the merchandise or novelties being conveniently assembled in one place for ready inspection by the firm's clientèle. During October the fall "Paris Conference" was held and the shops of Rue de la Paix were reproduced in the Stewart store with a complete stock of everything Parisian. At present there is being reproduced in the rotunda of the new Wanamaker Building a duplicate of the well-known Burlington Arcade of London. This is a collection of separate men's shops. In some clothing is offered; in others automobile costumes and accessories, luggage and wraps; another displays men's furnishings, umbrellas and canes; another is devoted to men's jewelry and carries everything from a scarfpin to a coin purse. There is a shop carrying a line of rare imported books, in exquisite bindings. Then comes a line of boots and shoes such as are found in Bond Street, London. There is a hosiery shop, with socks in all colors; a hat shop containing the latest European blocks; a social stationery shop, too, which provides cards, letter paper, engraved monograms, crests, etc.

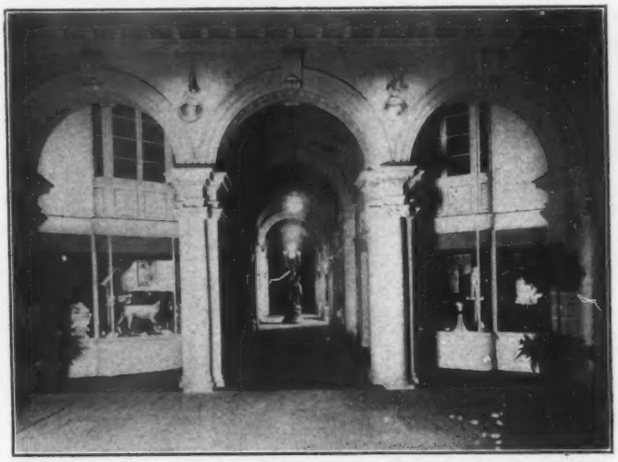


Fig. 1—Burlington Arcade Looking West From Fourth Avenue.

The sporting-goods shop contains goods ranging from a golf ball to a smooth-bore gun. There is a dainty perfumery shop and also a men's glove shop.

As these shops contain only European goods, imported specially for the Arcade, it will be seen that the effective and harmonious lighting of such a variety, comprising such a wide range of colors, was no easy task. The lighting was entrusted to the Westinghouse Electric & Manufacturing Company, which treated the Arcade as a single unit, entirely independent of the rest of the store lighting. The wiring and placing of outlets were done under the supervision of Mr. C. E. Clewell, illuminating engineer of the Westinghouse company. Mr. Fisher, of the lamp works, inspected the plans and structure and specified the types of lamps he considered best adapted to the show windows and passages.

Fig. 2—Jewelry, Perfumery and Leather Goods Sections.

It was realized at the outset that the rearranging of shop displays and stocks would cause vibration and disturbance and the Westinghouse "wire-type" tungsten was installed throughout.

The details and characteristics of this type of lamp were described in a paper by Mr. C. F. Scott before the St. Louis convention of the N. E. L. A. and can be found in the June number of this paper. The first 40-watt lamps built by the Westinghouse company went to Wanamaker's; the installation comprises 200 40-watt and twenty-two 500-watt lamps.

The Macbeth-Evans Company, Pittsburgh, Pa., cast twenty

14-in. "Alba" spheres for these 500-watt lamps, and the fixtures were installed by the Mitchell-Vance Company, of New York, which overcame the difficulties due to size, weight and the heavy sockets required. The Holophane Company furnished the reflectors specially adapted to the Arcade. Without giving details of the shop lighting, a suggestion is furnished by the jewelry shop, for which a satin-finished reflector was used

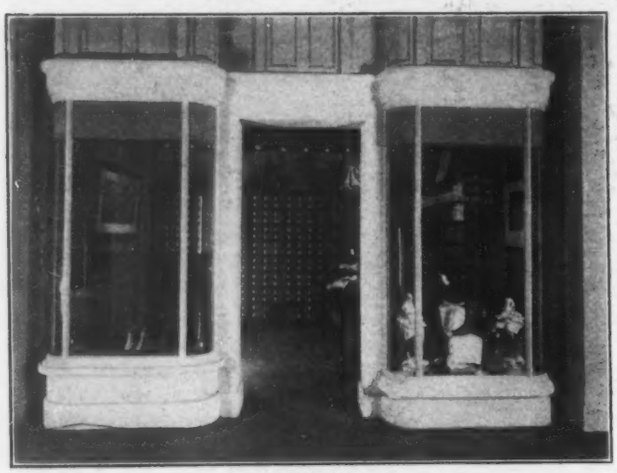


Fig. 3—Shoe and Hosiery Shops.

(in connection with a deep frosted lamp) which affords a low, intrinsic brilliancy and gives a pleasing white light. There is an entire absence of glare. The shape of each type of reflector was carefully chosen to correspond with the class of merchandise in each shop and 110 show-window reflectors were furnished in addition to enough resident reflectors. The Tungstolier Company furnished eighteen special brackets (in cloister finish) required by the unusual architecture of this temporary structure, which has less stability and strength than are usually available.

It is believed that this installation represents the highest skill in the electrical field. The different interests involved cooperated closely to furnish the best in scientific display lighting, at low cost, with far more beautiful effects than carbon-filament lamps offer. A number of shops in the Arcade are illustrated herewith. The illumination is withal cheerful and contrasts remarkably with the cold blue of the arc lamps used elsewhere

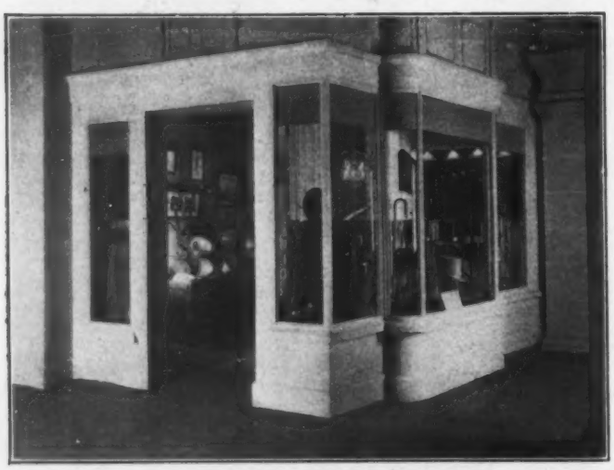


Fig. 4—Hat and Umbrella Shops.

throughout the store. Needless to state, the dingy aspect of the original Arcade is entirely lacking in the Wanamaker reproduction because of the modern and scientific illumination. The installation, moreover, is well worth a close study by store managers desirous of bringing out the true color values of merchandise by artificial light. In the field of economics it is destined to play an important pioneer rôle.

PRACTICAL VALUE OF ILLUMINATING ENGINEERING.

One of the features of the Baltimore convention of the Illuminating Engineering Society, held on Oct. 24 and 25, was a session devoted to the discussion of the advantages of illuminating engineering to various interests, papers by Messrs. W. J. Serrill, J. F. Gilchrist and V. R. Lansingh being read on this subject.

VALUE TO THE COMMERCIAL MAN.

Mr. Serrill said that the commercial man is dependent upon the illuminating engineer for the design and development of the electric and gas lamps which he has available to offer to the public. The physical and chemical principles underlying both of these forms of illuminants are abstruse, and each has reached its present efficient form through invention and research on the part of scientific men. It may be admitted that the commercial man need not master the principles underlying the design of lighting units, but constant co-operation and exchange of opinion between the commercial man and the laboratory man are essential. The latter is to a large extent dependent upon the former for a knowledge of the public taste, and of the extent to which the public purse will be opened to its gratification. In addition, the commercial man will understand the requirements demanded by the various kinds of buildings and of occupations, as affecting such points as the size of the unit, the distribution of light from it, its color, its daylight appearance, etc. The association together of these two classes of men at the sectional and annual meetings of the society cannot fail to be of benefit to the art of illumination.

It is evident that the commercial man, having at his command an assortment of lighting units, must, in his efforts to sell them, be possessed of a comprehensive knowledge of the salient characteristics of each of the units. Knowledge of this kind is essential to the commercial man in his efforts to sell and to meet the competition of other forms of illuminants. Here there is reached another point which emphasizes the importance of the commercial man attending the meetings of the Illuminating Engineering Society. At the meetings he learns how to interpret and utilize the data furnished by the laboratories.

Since practical considerations force the application of lighting units to interiors into the hands of the canvasser, it should be unnecessary to furnish an argument toward the education of the canvasser in the principles of illumination. Each company must solve for itself the problem of imparting this education; upon its success will depend whether or not the interiors covered by its field of operation are properly lighted. The author expressed the opinion that the Illuminating Engineering Society should become an active factor in the education of the lighting canvasser. Especially should the local sections take an active part. In these more time should be given to discussions of actual installations. Such installations, illustrated by diagram or photographic slide, when criticised and discussed in public meeting have a high educational value. Commercial men, members of local sections, should be encouraged to present descriptions of such installations and of interesting problems that arise in their experience.

The profession of illuminating engineering is emerging from the state of infancy; it is proper that the scientific principles which underlie the profession should have been mastered before the practical phases of the subject come to the fore. The society is now in a position to devote more time to the latter.

The practice of illumination is not only an art, but is also a profession. Those arts in which the processes are so simple that no knowledge of the underlying principles is needed in order to practise them are arts pure and simple; in proportion as the processes become complex and involved, and as the problems contain many variable quantities, a knowledge of these principles becomes essential, and the art merges into a profession. The more complex the problems involved in illumination, the more numerous the practical obstacles, the

more essential becomes a knowledge of, and a constant reference to, the principles which underlie the profession of illuminating engineering.

The author contended that the profession of illuminating engineering deals with an important subject, fraught with grave consequences to the future of our race. Conserving the most vital one of those five senses which form the connecting links between the personality of the individual and the physical world, it is destined to exercise an important influence on the progress of civilization. It enlists the services of the physicist, the chemist, the mathematician, the physiologist, the oculist, the manufacturer, the architect, the artist, and in this list the commercial man holds an honorable and commanding position. No one, two or three of the types of men here named can solve the multifarious problems of the profession. It requires the services and the co-operation of them all. The profession cannot afford to have any one of them hold aloof, and it will prosper in proportion to the degree of co-operation and of interchange of opinion that is maintained and to the extent to which those individuals who compose each group endeavor to broaden their views by obtaining as great a knowledge as possible of the activities of the other groups. The commercial man cannot afford to remain ignorant of the progress of illuminating engineering. The best basis upon which to build the knowledge and experience of salesmanship in this commodity is a familiarity with the principles of illuminating engineering.

VALUE TO THE CENTRAL STATION.

In the paper by Mr. Gilchrist it was stated that there can be no doubt as to the very great desirability from the standpoint of their own interests of the central stations fostering the development of illuminating engineering and the training of the young men in the industry to a thorough knowledge and appreciation of the fundamental principles of proper illumination.

Until within the past few years a comparatively small number of men in the electric lighting business have been impressed with the importance of this sort of intelligence and tralning the attention of most of the best minds having been directed toward the development and operation of apparatus for the generation of electricity and to the engineering problems which pertain to the transforming and the distributing systems incidental to the supply of energy to customers from a central-station plant. It is only recently that, through the work of specialists advanced in their profession and the influence of the Illuminating Engineering Society and kindred organizations, intelligent attention has been given to the very important matters of utilizing the light produced in the most proper, hygienic and economical ways.

Under this new order, however, remarkable progress has already been made in the development of illuminants which are more economical and which are better adapted for various forms of lighting, and the standard of artificial illumination has been increased more, perhaps, than the standard of any other modern product. To appreciate this fact fully one who has been in the business for any considerable length of time has only to compare the illumination in the store of some conservative customer where five or six years ago he laid out a system of illumination in which he took great pride and which has not subsequently been changed with what he considers proper present-day illumination in some similar store recently equipped.

The above simple observation will prove several things. It will prove the advance in the standard of illumination. It will prove to those who have looked on both installations as masterpieces of the period how much advancement has been made in the knowledge of illuminating engineering, although the obtaining of this education may have been involuntary and by a process of absorption rather than through any premeditated effort, and the old unchanged installation by its very rareness will prove to what extent the layman has acceded to the compelling force of the times demanding higher standards of illumination.

It is in this point of the education of the customer that one of the great practical values of illuminating engineering to the central station lies. The progressive layman will rarely turn a deaf ear to reasonable views and advice tending toward better illumination.

The central-station manager should wake up thoroughly to the fact that in the lighting end of his business what he should sell is an effective and useful illumination and not merely electricity, but he cannot sell the former without the aid of representatives who are thoroughly well educated and up to date in matters of illumination, and in such representatives he has nothing more or less than a corps of illuminating engineers, despite any prejudices he may entertain.

The Illuminating Engineering Society has accomplished a vast amount of good for the central stations in the work which it has done up to the present time. Perhaps it has not received the hearty support of the central stations in the way that it should have done, but the work is only begun and it should feel only the greatest amount of encouragement for what it has accomplished and keep on in a larger way year by year. Central-station managers must see their interests and be shown them if they do not see them, and a larger number of the rank and file of the young men selling illumination must be secured as members of the society and placed within the influence of its educational features.

The author remarked that a splendid advance was made in the course of lectures arranged to follow the convention of the society. The society should consider some means of extending these benefits to a very much greater number of men engaged in the practical work of selling illumination than could possibly be gathered together at any one place. Results could possibly be accomplished by giving this form of instruction from several centers, or, better yet, some correspondence arrangement with examinations, etc., might be arranged which would insure the proper amount of individual work on the part of students. With the proper stirring up there should be no difficulty in providing the necessary funds for such courses of instruction, because, from the standpoint of the central station, there is no more practical work in the industry than that being done by the Illuminating Engineering Society.

VALUE TO THE MANUFACTURER.

Mr. Lansingh discussed particularly the value of illuminating engineering to the manufacturers of illuminants, shades and reflectors, appliances and contributing apparatus. He said that a knowledge of illuminating engineering will teach the consumer to choose correctly the character of illuminant desirable for the work in hand, which will lead to a wider extension of such illuminant for such work. Illuminating engineering teaches the salesman of the manufacturer to solicit business intelligently, placing him in a decidedly advantageous position over his competitor who has not this knowledge. It puts the manufacturer employing such methods above his competitors not employing them, making it, therefore, more easy to sell his goods.

A comprehensive knowledge of illuminating engineering not only in its broadest sense, but in its more narrow and usual application, must be employed. Thus, in the case of prismatic reflectors, there are all sorts of candle-power distributions which have been obtained to fit different conditions, as, for example, the so-called "extensive," "intensive" and "focusing" forms of distribution, all of which have been designed to fulfil lighting conditions which it would have been impossible to produce or even know the requirements of without a proper knowledge of illuminating engineering.

Under the heading of appliances the author included all of those devices that are directly applicable to the illuminants themselves. Thus, there are the fixtures used to support the illuminants and their shades or reflectors; the burners in connection with mantle gas lighting; the sockets for electric lamps; the tips for open gas and acetylene lighting, as well as numerous other appliances. The fixture manufacturer has been, generally speaking, slow to recognize the value of illuminating engineering as applied to his art; but to-day the most progressive houses are recognizing its value and are accordingly taking advantage of it, much to their financial benefit, especially in commercial lighting.

The value of illuminating engineering to the manufacturers

of contributing apparatus is indirect rather than direct, but that its value is great no one would deny. Thus in the incandescent electric lamp field the extension during the past few years into new fields has been tremendous, all of which means a larger demand for apparatus of all kinds. The manufacturers of the electric generator, the steam boiler and all the other necessary parts to a generating station—conduits, wire, porcelain—and all the appliances necessary for the distribution of electrical energy have been greatly benefited by the large increase in the use of electric energy, by reason of a more thorough appreciation of its advantages by the public, which have been largely caused by its correct use, due to a knowledge of illuminating engineering, either on the part of the customer or those responsible for the sale of illuminants.

Discussion.

In the discussion of the above three papers Mr. G. H. Stickney read a communication from Mr. W. D. A. Ryan in which attention was directed to the desirability of co-operating with the architects, who usually determine the illumination scheme to be employed in important buildings.

Mr. E. B. Rowe stated that when approximate methods are developed for the use of persons not well versed in illuminating engineering principles especial care should be exercised to insure accuracy in the interpretation of the results obtained by the methods.

Mr. E. L. Elliott claimed that the necessity exists at the present time of educating the contractors and builders with reference to the requirements of illumination, in order that the illuminating equipment may be properly selected while the building plans are being considered.

Mr. G. E. Williamson explained the results obtained by the Denver Gas & Electric Company from applying illuminating engineering principles in arranging lighting installations for its customers. He said that the best feature of the work was the confidence inspired in the customers by the excellent results from following the advice of the company concerning the illumination.

Letters to the Editor.

Converter Substations.

To the Editor of Electrical World:

Sir:—When reading the article on "American Switchboard Practice" in your Aug. 4 issue the writer was under the impression that the cut illustrating a cross-section of a converter substation referred to a substation built by the Boston Elevated Railway Company. The similarity to a substation designed and built by the Brooklyn Rapid Transit Company at an earlier date was commented upon in a letter published in your columns some weeks later.

Since the author of the article on "American Switchboard Practice" has confirmed the writer's impression by his reply of Oct. 6, and further takes the credit for the originality of the design of the Boston substation, I wish to take exception to these claims.

About the time that the engineers of the Boston Elevated Railway Company were contemplating the extension of their system by the addition of converter substations, they visited several of the largest railway systems in the East, and, of all the substations visited, the Thirty-eighth Street station of the Brooklyn Rapid Transit Company impressed them the most. They, therefore, requested drawings of this substation and a complete set of drawings was accordingly furnished to them. They also visited this substation on several occasions at later dates for further information and to make sketches while they were working up the details of their own substation.

I wish now more fully to emphasize my previous statement regarding the arrangement of apparatus and station layout of the station in question, as described and shown in cross-section, and would say that the cut illustrating the Boston substation is not only similar to, but is an exact duplicate of, our Thirty-eighth Street station in the following particulars:

Entrance of high-tension cables into station; wiring to oil switches through disconnecting switches and to high-tension buses; wiring from high-tension buses, through disconnecting switches and oil switches, to transformers and from transformers, excepting alternating-current starting switches, to rotary and to switchboard and outgoing direct-current feeders; the location of negative bus and connection through pedestal switch to rotary; the location of the direct-current and alternating-current feeder pits; location of oil switches and position of disconnecting switches; the construction of gallery for the high-tension bus compartments and battery-room and duplicate high-tension bus arrangement; also the construction of the air chamber and rotary foundation walls.

I would further state that the author of the article here referred to also visited the Thirty-eighth Street station, seeing it in actual operation at a date considerably previous to putting into service the Boston substation, and it is with much surprise I note that he now lays claim to the design of the Boston station, knowing it to be a direct copy, even to small details, of a station previously built.

As to the Thirty-eighth Street station being representative of American switchboard practice, I would question as to where there is another station which is in any way similar or any company where the double high-tension bus is even common practice. The Thirty-eighth Street substation was developed as the result of several years' experience by the Brooklyn Rapid Transit Company and the plans were drawn up entirely by its engineers, without outside assistance; moreover, the plans were not submitted to any manufacturing company for approval and certainly do not represent the practice of any manufacturing company.

I wish also to correct the statement that the Thirty-eighth Street station was designed for 6600 volts, as it is designed throughout to operate at from 11,000 volts to 15,000 volts.

In view of the above facts I fail to see the correctness of the statements of Mr. Hayes, although I do not deny that he may have made suggestions as to the type of rotary and checked the details of station wiring and the method of starting.

In regard to the type of rotary adopted, method of starting used and transmission voltage and the manufacturing company furnishing the equipment, these do not enter into the discussion, as the original comments made by the writer were with regard to the station in question being a copy of a station built by the Brooklyn Rapid Transit Company.

Brooklyn, N. Y. A. K. Miller.

Arc Versus Tungsten Lamps for Indirect Illumination.

To the Editor of Electrical World:

Sir:—In the letter "Arc Versus Tungsten Lamps for Indirect Illumination" in your issue of Oct. 6 there appears in the last paragraph a statement that the loss in efficiency due to

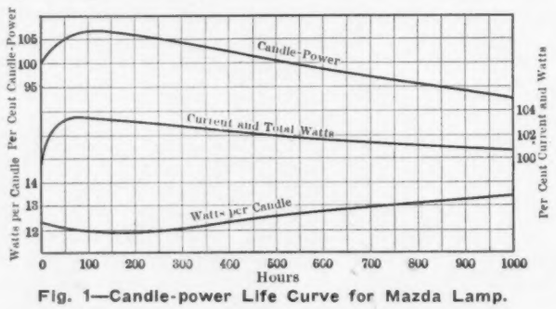


Fig. 1—Candle-power Life Curve for Mazda Lamp.

the rapid deterioration of tungsten-filament lamps may be safely figured at from 25 per cent to 40 per cent during the life of the lamp, and that an allowance should therefore be made for this loss when comparing arc and tungsten lamps.

I quite agree with Mr. Eznuk that all comparisons between various illuminants should be based upon the average rather than the initial performance of lamps, but I am not of the opinion that it is necessary to discount the initial candle-power values on metallic-filament lamps when comparing them with arcs. In a bulletin recently issued by the Engineering Department of the National Electric Lamp Association I find the candle-power life curve for "Mazda" lamps which is shown in Fig. 1. Fig. 2 is taken from the "Standard Hand Book for Electrical Engineers," and shows the candle-power life curves for enclosed-arc lamps. The following explanation of the curves is given in the "Standard Hand Book":

"The only other loss in arc lamps which is variable with time is, in the enclosed arc, the loss of light due to the coating formed on the inner globe between successive trimmings. This is not negligible, although very variable in amount. Fig. 2 shows a typical result obtained by Matthews from a

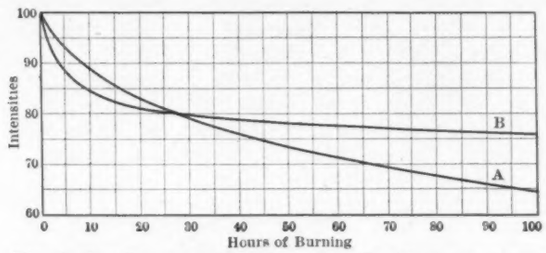


Fig. 2—Candle-power Life Curve for Enclosed Arc Lamp.

direct-current enclosed arc. The deposit forms more thickly in the upper part of the globe than in the lower, so that *A*, above the arc, shows more loss than *B*, below the arc. The mean loss of light is 20 per cent to 25 per cent, an amount that must be reckoned with when comparing arc lamps with incandescents."

Cleveland, Ohio. WARD HARRISON.

Bedding of Wire in Magnet Coils.

To the Editor of Electrical World:

SIR:—An erroneous idea that seems to be peculiarly persistent is that the convolutions in each layer of a magnet-coil "bed" between the ridges formed by the convolutions in the layer immediately beneath the one considered, and thereby increase the space factor of the winding. This notion originated, I believe, with Prof. Silvanus P. Thompson, and almost every writer who has discussed magnet windings since this fallacy was started has accepted it blindly and passed it along.

As a matter of both theory and fact, the "bedding" above mentioned, which is so scientifically reckoned on by many writers, cannot possibly occur except at two points, diametrically opposite, in each convolution; the remainder of the convolution crosses the convolution beneath it at a very acute angle, but it *must cross*—it cannot bed for any appreciable distance. The only effect of such momentary bedding as does occur is to distort the shape of the coil perimeter from a true circle, if the core be round, or to reduce the thickness of the coil section slightly at the corners, if the core be of oblong or rectangular cross-section.

What does happen, and to a considerable degree with cotton-covered wires of relatively small sizes (about Nos. 18 to 24), is that the insulation is compressed slightly between the layers by the tension put on the wire during the process of winding the coil. This, however, is rarely sufficient to compensate for the waste of space by the irregular winding of small wires or the reversal of the "thread" at the ends of a coil wound with a large wire. I have directed the construction of several hundred magnet coils and have never been able to get as many convolutions in a given section as the familiar formula,

$$\frac{W\,\Delta}{d^2} = \text{convolutions},$$

indicated, except when the width W and the depth Δ of the coil were made an exact multiple of the insulated diameter d of the wire, and the latter was fairly large. Except with wires of about Nos. 10 to 14 gage it is usually impossible to get the full theoretical number of convolutions by any method of winding commonly used in factories devoted to the manufacture of electrical machinery. Of course, I am aware of the precision with which coils of very small wire are wound by automatic machines, but those are not commonly used in plants of ordinary size and equipment devoted to the manufacture of electrical apparatus.

New York. CECIL P. POOLE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Braking Induction Motors.—R. E. HELLMUND.—A discussion of the method of braking an induction motor by means of direct current supplied to the stator. The simplest way of supplying direct current to a star-connected three-phase stator is to pass the current into one phase and use the two other phases in parallel as return. Other possibilities are also discussed and illustrated by diagrams. The fundamental theoretical considerations on which this method is based are given, together with the principal formulas and characteristic curves. The chief disadvantage of the method is that direct current is required and that a converter must, therefore, be provided. Its capacity does not need to be more than 5 per cent or 10 per cent of the motor capacity, but it is an undesirable complication. Even if direct current is available, it cannot be used to advantage, since the usual voltages are too high, so that considerable energy has to be wasted in a series resistance. A further disadvantage of the method is that under practical conditions high saturation in the iron must be employed, which results in iron losses in the rotor and in considerable mechanical stresses in the motor.—*Elek. u. Masch.* (Vienna), Oct. 2.

Self-Exciting Alternators.—P. BUNET AND M. LATOUR.—An article illustrated by diagrams on the possibility of operating single-phase commutator motors with a series characteristic as self-exciting generators, with special reference to the Latour series motor and the repulsion motor.—*L'Industrie Elec.*, Sept. 25

Stray Fields of Transformers.—W. ROGOWSKI.—A theoretical paper illustrated by diagrams. The author first gives the conditions under which only stray fluxes, without any mutual flux, are obtained in a transformer. This is the case if the primary and secondary windings are supplied with currents in such a way that the primary amp-turns are exactly equal and opposite to the secondary amp-turns. With a transformer of the transformation ratio of 1 to 1 this condition is fulfilled if the two windings are connected in series and opposite to each other, as shown in Fig. 1. In this case the sum of the stray inductances of *AC* and *BC* of the transformer equals the self-induction of the single circuit *ACB*. Any method of measuring self-induction can, therefore, be employed for investigating the stray fluxes of a transformer. Two such methods are described which can be directly applied if the transformer has a transformation ratio of 1 to 1 by connecting the two windings opposite to each other as in Fig. 1. If the transformer has another transformation ratio it is necessary to employ an auxiliary transformer of the same transformation ratio.

The author then discusses the stray fluxes of two coaxial rings of equal size and two infinitely long coaxial coils. The article is to be concluded.—*Elek. Zeit.*, Oct. 13.

Transformer Oil.—Henry.—An account of a report of a committee (consisting of Gerard, Goffin and Lepouse) of the Belgian Society of Electrical Engineers on tests of oil for transformers and high-tension interruptions. The report deals with rapid preliminary tests, the method of charging the oil into the transformer, precautions in the storage and shipment of the oil, practical methods of drying large quantities of oil, specifications for insulating oil, tests of dielectric strength, and investigations of physical and chemical properties.—*L'Industrie Elec.*, Oct. 10.

Mercury-Vapor Rectifier.—W. Hechler.—An illustrated paper read before the Berlin Electrical Society on the latest practical forms of mercury-vapor rectifiers. In the discussion Orlich stated that they used this rectifier in the Reichsanstalt with good success for charging batteries over night without any attendance. Iron resistors in a hydrogen atmosphere are used in series with the battery. Strecker stated that the German telegraph department has used the rectifier successfully for charging batteries. The efficiency of about 80 per cent has been obtained. Passavant emphasized that the rectifier might be useful for charging batteries in engine houses, since many of the German fire departments are about to use automobile engines.—*Elek. Zeit.*, Oct. 13.

Lamps and Lighting.

Vacuum-Tight Seal Between Iron and Glass.—H. J. Sand.—A longer account of his recent British Association paper, which has already been briefly noticed in the Digest. Vacuum-tight seals for the introduction of wires into glass can be obtained by making use of the elasticity of small steel tubes serving as caps. The method is as follows: An iron wire (*b*, in Fig. 2)

Fig. 1—Transformer Connections for the Measurement of Stray Fluxes.

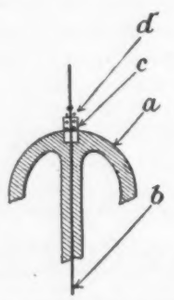


Fig. 2—Vacuum-Tight Seal Between Iron and Glass.

is sealed into the glass *a* and a small piece of heated steel tubing *c* is pushed a few millimeters into the glass while the glass is still hot; after cooling, the tube is soldered to the wire, as indicated by the dots *d*. The contracting steel tube forms a vacuum-tight seal between the inner surface of the tube and the glass inside it, which is put under compression. Tubes into which iron wires of 1 mm (39 mils) had been sealed in this manner were pumped out to a cathode-ray vacuum four months ago and their vacuum has remained unchanged since. In the earlier experiments the seal was usually arranged inside the evacuated tube, because any air trapped between the wire and the glass would be difficult to remove if the seal were outside. A London firm of glass-blowers, however, has recently made cathode-ray tubes with the seals outside. Seals between iridium and quartz glass, into which so far wires had not been introduced, seemed to be realizable in the same way. Whether these seals would technically replace platinum seals could not yet be said.—Lond. *Eng'ing*, Sept. 30.

Electric Arc in Low-Pressure Atmosphere.—H. Buisson and C. Fabry.—An account of an experimental investigation of the behavior of the electric arc between metals in a low-pressure atmosphere. In order to obtain well-pronounced spectrum lines low pressures must be employed. When the substance whose spectrum is desired is a non-volatile metal, such as iron, the only way is to set up an arc in a low-pressure atmosphere, using the metal for electrodes. Experience shows, however, that this arc, which is stable in free air, is much less easy to produce at low pressures. It is extinguished when the points are separated, or else plays between other points than the ends of the electrodes. The conditions necessary for the maintenance of a steady arc in a low-pressure atmosphere have been studied for iron, and it has been found that stability is obtained when the negative electrode is covered with oxide. When the arc is struck in free air the electrodes melt and oxidize. The arc, having been extinguished, is re-struck in vacuo and burns steadily. The same result has been obtained with both copper and nickel. These facts are in accordance with the electronic theory of the arc, according to which the cathode is the seat of emission of abundant electrons, due to its high temperature. The non-volatile metals, such as iron, emit but few electrons, and, in consequence, are only ill fitted to serve as cathodes, while oxides and carbon emit intense negative charges, which fact explains their efficiency. For easily volatile metals the presence of oxides is not necessary, as, for instance, for mercury in the Cooper Hewitt lamp; while a stable arc can be obtained between electrodes of zinc or magnesium in low-pressure atmospheres or in hydrogen.—*L'Industrie Elec.*, Sept. 10; Lond. *Electrician*, Oct. 14.

Train-Lighting System.—A note on a recent British patent (21,219, Oct. 6, 1910) of W. F. Anderson, S. A. Russell and W. E. Gray. This is a two-battery system, in which current can be supplied to the load by both batteries when the dynamo is running below a certain speed. Above this speed the load is supplied and one battery charged simultaneously. A current proportional to the charging current passes through a demagnetizing winding on the field magnets of the dynamo to prevent charging at an excessive rate. When the load circuit is open the two batteries are charged in parallel.—Lond. *Elec. Eng'ing*, Oct. 13.

Generation, Transmission and Distribution.

French Transmission Line.—De Kermond.—An account of the 60,000-volt transmission line between Ventavon and Villeneuve. This line is connected with a hydroelectric station whose present capacity is 24,000 hp, using falls on the Durance. Francis turbines are employed, the head being 160 ft. There are four turbines, each with a capacity of 6000 hp, and these are connected to 4500-kva, three-phase generators, supplying energy at a pressure of 7000 volts to 8000 volts at a frequency of 25. The voltage is stepped up for transmission by four groups of single-phase transformers. Electrolytic lightning arresters are used for a protection, being connected with the high-tension line through horn arresters. The high-tension switchgear is worked from the switchboard by means of 120-volt direct-current motors. The generators are fitted with Tirrill regulators so that the voltage at the Arles and Marseilles substations can be kept constant. The transmission lines consist of three aluminum wires, each 0.2 sq. in. cross-section, which are fastened to bell insulators 14 in. high and of the same diameter. Steel angle-iron masts 50 ft. high are used, the masts being 80 yd. apart. To prevent electrolytic action at places where the aluminum wires join those of copper the joint is made in an ebonite tube, which is filled in with a mixture of paraffin wax and Chatterton compound.—*L'Electricien*, Aug. 27; abstracted in Lond. *Electrician*, Oct. 14.

Electric Drive for Printing Machinery.—A description of an arrangement for driving and controlling printing machinery by means of a reversible booster set. The speed of the paper on the machine in question varies from 3 m to 96 m (10 ft. to 312 ft.) per minute. Three-phase currents at a pressure of 500 volts and a frequency of 50 are obtained from the mains. The parts of the machine which run at a constant speed are driven by two induction motors, each having an output of 15 kw to 17.5 kw. These are controlled by oil starters in the rotor circuit. The set driving the variable speed part consists of a three-phase induction motor of 90 kw capacity and running at

975 r.p.m., coupled to a compound-wound dynamo supplying 175 amp at 220 volts and to a separately excited reversible booster which supplies a current of 170 amp at a pressure of 220 volts. Starting is effected by means of a liquid rheostat. The driving motor is fed with current at a variable pressure from this group and develops a maximum power of 65 kw. All the continuous-current machines are fitted with interpoles. The reversible booster and the driving motor are excited from the compound dynamo and are regulated by a field rheostat according to the paper speed. The dynamo-field rheostat has 156 contacts and that of the motor twenty contacts. By varying the voltage of the current supplied the speed of the motor can be regulated between 50 r.p.m. and 80 r.p.m. The motor is connected to the machine by means of a belt and gearing, the reduction ratio being 1 to 2. The motor and the gearing are fixed in a house close to the machine-room, while the regulators are near the machine itself.—*L'Industrie Elec.*, Sept. 25; abstracted in Lond. *Electrician*, Oct. 14.

Traction.

Single-Phase Traction.—BANDOW.—An illustrated paper read before the Berlin Electrical Society on the Bergman-Westinghouse single-phase traction system. It has been worked out on the basis of the patents of the Westinghouse companies and their experience, with special reference to German conditions.—*Elek. Zeit.*, Oct. 13.

Installations, Systems and Appliances.

German Electrical Industry.—G. DETTMAR.—The conclusion of his illustrated lecture on the present conditions of the electrical industries in Germany, dealing with electric traction and electrochemical industries. It is stated that for the fixation of atmospheric nitrogen by electric discharges at present 150,000 hp to 200,000 hp are employed in "German establishments" in operation or in course of erection (this probably means plants erected or backed by German companies; it cannot mean plants located in Germany). The German industry for the production of caustic soda and chlorine by electrolysis of common salt employs 40,000 hp to 50,000 hp, the production of cyanamide 30,000 hp, the production of metallic sodium 10,000 hp, and the production of aluminum 15,000 hp in "German plants." Reference is then made to electric steel refining and to the use of electricity in the house for heating and cooking and for purifying the air by means of fans and ozonizers. Finally a review is given of telephony and telegraphy in Germany. An abstract of this part of the paper is found elsewhere in the Digest.—*Elek. Zeit.*, Oct. 13.

Melbourne.—An abstract of last year's financial report of the municipal electric station of Melbourne. The total connections to the mains were 10,064 kw, the number of consumers 3212, of which 1178 were taking a supply for power and heating. The total number of motors connected to the mains was 1441, representing 4684 hp. For private lighting 3,654,063 kw-hours (an increase of 273,901 over last year) were sold, for power and heating 2,560,991 kw-hours (increase, 649,636). Including public lighting the total number of kw-hours sold was 8,159,963 (increase, 1,067,696). The average revenue per kw-hour was 6.66 cents for the whole supply, the individual figures being 8.24 cents for private lighting, 3.72 cents for power and heating, and 6.12 cents for street lighting.—Lond. *Electrician*, Oct. 14.

Electric Equipment of Laboratory.—A description of the new generating station of the Northampton Polytechnic Institute, which contains two 100-kw gas-engine sets generating 220-volt direct current and 2200-volt three-phase currents. The oil switches of the alternating-current circuits are controlled from a modern desk-type board equipped with the latest instruments and auxiliary appliances. A 45-hp synchronous motor-generator set, a 30-kw rotary converter and a 600-amp-hour battery with a reversible booster-balancer are also installed.—Lond. *Elec. Eng'ing*, Oct. 13.

Battery Plant.—A note on a recent British patent (18,636, Oct. 6, 1910) of A. M. Taylor. In order to reduce the cost and increase the efficiency of battery plant arrangements are made for connecting two or more booster armature windings in series and in parallel, and an auxiliary or "bucking" booster is employed during charging with the object of increasing the number of cells in the battery and reducing the output of the main boosters. Instead of a bucking booster a number of additional cells may be employed in conjunction with suitable switchgear. This enables the battery to float on or discharge lightly into the main busbars without the boosters.—Lond. *Elec. Eng'ing*, Oct. 13.

Starting Rheostats.—R. EDLER.—An article describing a simple graphical method for calculating the different steps of the starting resistance of a shunt motor. The graphical method described requires no complicated logarithmic calculations.—*Elek. u. Masch.* (Vienna), Oct. 2.

Wires, Wiring and Conduits.

Cables.—F. FERNIE.—A continuation of his very long serial on electric cables. The author takes up a discussion of the choice of cables and methods of laying. He first details the circumstances upon which depend the choice of cable and method of installation for a particular system and describes the difficulties which have to be overcome in successfully meeting the conditions—extra-high-tension, high-tension and low-tension cables being all dealt with. The influence of cost on these problems is also mentioned.—Lond. *Electrician*, Oct. 14.

High-Tension Transmission Lines.—HENRY.—An illustrated description of several details of high-tension overhead lines, dealing with the wire, the supports, the insulators, protective devices and safety devices to protect against rupture.—*L'Industrie Elec.*, Sept. 25.

Electrophysics and Magnetism.

Peltier Effect.—H. C. BARKER.—An illustrated description of a new method of measuring the Peltier e.m.f. in absolute units. The mean value of ten results obtained by this method is 6.75×10^{-3} volts at 28.7 deg., or 1.61×10^{-3} calories per coulomb. Jahn's results give at 0 deg. 5.08×10^{-3} volts; Czermak finds at 19 deg. 8.04×10^{-3} volts.—*Phys. Rev.*, October.

Skin Effect.—A. R. GARNIER.—A long article giving formulas for the ohmic resistance and reactance of conductors of large cross-section carrying alternating current, and diagrams for practical use.—*L'Industrie Elec.*, Aug. 10 and Sept. 10.

Alpha Particles.—E. RUTHERFORD AND H. GEIGER.—Two papers, one dealing with the number of alpha particles emitted by uranium and thorium and by uranium minerals, the other with the probability variations in the distribution of alpha particles.—*Phil. Mag.*, October.

Electrochemistry and Batteries.

Metallic Radium.—MME. CURIE AND M. DEBIERNE.—A French Academy paper. Radium amalgam is prepared by electrolysis of a radium chloride solution with a mercury cathode, and the mercury is then distilled off from the amalgam to get metallic radium.—*L'Industrie Elec.*, Oct. 10.

Units, Measurements and Instruments.

Weston Cadmium Cell.—S. W. J. SMITH.—A paper read before the (London) Physical Society on the limitations of the Weston cell as a standard of e.m.f. This paper contains an attempt to explain in terms of the theory of solutions F. E. Smith's recent experiments on the cadmium amalgams of the Weston cell. The manner in which the amalgams crystallize is indicated, and it is shown why the effect of the slowness of diffusion is so pronounced. A comparison of "chilled" and "slowly cooled" amalgams is made and the small irregularities of Weston cells are discussed. Finally, the question as to whether there is any range over which the e.m.f. is absolutely independent of the percentage of cadmium is discussed.—Lond. *Electrician*, Oct. 14.

Complex Compensator for Measuring High-Frequency Alternating Currents.—A. LARSEN.—For making measurements in connection with telephone instruments and telephone cables a compensation method is employed in which the voltage used for compensation is composed of two partial voltages in series with each other, but differing in phase by 90 deg. When making the measurement the two partial voltages are adjusted until the joint resulting voltage compensates the voltage to be

measured. The arrangement is shown in Fig. 3. Any source of alternating current supplies the compensating current which passes through the testing wire *AB* and the coil *BC*. The contact point KK_1 can be adjusted. The alternating current in *BC* induces an alternating e.m.f. in an adjoining coil. The contact K_2 is indicated as being adjustable, but in practice the adjustment is made by varying the relative position of the two coils. The joint voltage P_1P_2 must compensate the voltage to be measured which is applied to P_1P_2. Adjustment of K_1 and K_2 is made until no sound is heard in the telephone. The author has applied the method for determining the efficiency of a telephone transformer, which was thus found to be 88 per cent. The arrangement of this test is shown in Fig. 4. *G* is a high-frequency generator, *F* a frequency meter, *HT* an auxiliary transformer with two secondary windings. One of these windings is connected with the compensator, the other winding with the transformer *T* to be tested. R_1 and R_2 are resistances and L_2 an inductance. The primary current is measured by connecting P_1 and P_2 with 1 and 2 respectively, the primary voltage by connecting P_1 and P_2 with 2 and 3 respectively, the secondary current by connecting P_1 and P_2 with 4 and 5 respectively, and the secondary voltage by connecting P_1 and P_2 with 5 and 6 respectively. The method can also be used for determining inductances, effective resistances, etc.—*Elek. Zeit.*, Oct. 13.

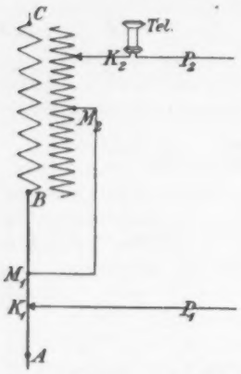


Fig. 3—Diagram of the Complex Compensator.

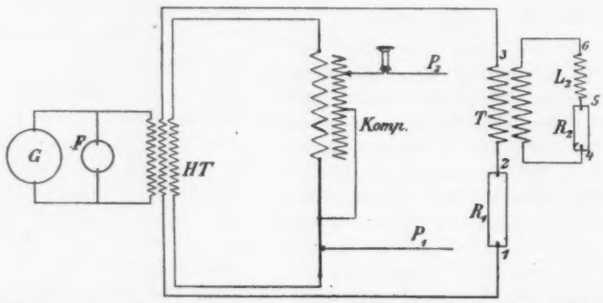


Fig. 4—Compensator Connections for Measuring Efficiency of a Telephone Transformer.

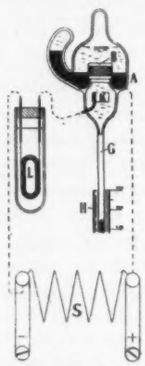


Fig. 5—Direct-Reading Electrolytic Meter.

Excess Power Meter.—An illustrated description of a meter shown at the recent exhibition of the Physical Society in Paris for recording the quantity of electrical energy consumed above a certain prearranged amount of power. An ordinary direct-current or alternating-current meter is used, the axle of which is provided with a concentric cylinder of nickel revolving between the pole pieces of a permanent magnet. The moving part of the meter has to overcome the counter torque due to the energy consumed by hysteresis in the nickel cylinder. The work of hysteresis per revolution is constant for a given value of the field in which the nickel cylinder revolves and independent of the angular speed of the latter. The counter torque is, therefore, also constant and independent of the speed of the axle. The meter is unable to start until it can overcome the counter torque and will register at any moment only the excess of energy over that required for starting.—*L Industrie Elec.*, Oct. 10.

Electrolytic Meter.—An illustrated description of the Stia electrolytic meter in which the amp-hours are read in the same simple manner as the temperature from a thermometer. As shown in Fig. 5, a glass globe contains metallic mercury *A* covered by a solution of a mercury salt, for instance nitrate. The mercury *A* is the anode, while the iridium film *K* forms the cathode. By electrolytic action the mercury is set free at the cathode and drops down in form of droplets into the measuring tube *G*. The height of the column of mercury in the tube gives directly the number of amp-hours. The connections are so made that only one-hundredth of the current to be measured passes through the meter. For this purpose the meter is connected in series with a high resistance *L* and the two are in parallel with the shunt *S*.—*L'Industrie Elec.*, Oct. 10.

Celluloid Condenser.—G. Vallauri.—An account of experiments with condensers made up of iron plates separated by celluloid sheets. In building up the condenser the sheets were moistened with amyl acetate and subjected to mechanical pressure as each unit was added, so as to get good adhesion between the surfaces and to expel the air. The material used was commercial black celluloid of a horny texture. A condenser of this kind has the peculiarity of being much slower in charging than any hitherto constructed. From the theoretical point of view the results obtained are insufficient to decide to what extent they may be dependent upon (1) phenomena of imperfect polarization, (2) variations in the resistance caused by the polarization itself or by the passage of conduction currents, or, finally, phenomena of electrolytic or other character. Practically the evidence is conclusive that such a type of condenser is entirely unsuitable on alternating-current distribution systems. Its slowness in charging gives a very small capacity with ordinary frequencies. Its power factor being more nearly unity than 0, it wastes an excessive amount of energy in heat, with a consequent rapid deterioration, so that it would afford no guarantee of safety when used on high pressures.—Lond. *Electrician*, Oct. 14.

Fused Silica.—G. W. C. Kaye.—An account of an experimental investigation of the expansion and thermal hysteresis of fused silica. The coefficient of expansion in various temperatures ranging between — 160 deg. C. and + 1100 deg. C. is as follows:

−160° to −120° C.	−0.43 x 10⁻⁶
−120 " − 80	−0.11 "
− 80 " − 40	+0.14 "
− 40 " 0	0.31 "
0 " 30	0.42 "
30 " 100	0.53 "
100 " 500	0.58 "
500 " 900	0.50 "
900 " 1000	0.80 "

These results refer to clear, transparent, annealed silica. The expansion curve shows two change points, one at about 1000 deg. C., the other at about —80 deg. C. Some observations were also made on thermal hysteresis. The author found that silica compares very favorably with two common Jena thermometry glasses specially designed to show a small after-effect. It is concluded that fused silica has qualities which commend it for use as a material for standards of length. A silica standard meter is on the point of completion at the National Physical Laboratory.—*Phil. Mag.*, October.

Electromagnets.—E. Jasse.—The first part of a long theoretical paper on the calculation of electromagnets. In the introductory instalment the author takes up the fundamental equations for the work done by electromagnets and the force exerted by them. A graphical method is described for predetermining electromagnets, while formulas for special electromagnets are to be given in later instalments.—*Elek. u. Masch.* (Vienna), Oct. 2.

Measuring Instruments.—An illustrated description of various instruments exhibited at the recent exposition of the Physical Society in Paris, including an excess power meter, the O. K. watt-hour meter, a recording frequency meter, galvanometers, an electrolytic meter, moving-coil instruments for alternating current, the Fery meter and the Irwin hot-wire oscillograph. Several of these instruments are or will be described separately in the Digest.—*L'Industrie Elec.,* Oct. 10.

Telegraphy, Telephony and Signals.

Telegraphy and Telephony in Germany.—G. DETTMAR.—In a review of the present conditions of electrical industries in Germany the following data are given on telegraphy and telephony. There were at the end of 1908 in Germany 41,394 telegraph stations and 33,541 cities or towns with telephone connection. The total length of telegraph and telephone lines was 325,143 km (202,000 miles), while the total length of telegraph and telephone conductors was 5,160,638 km (3,200,000 miles). There were transmitted 54,098,541 telegrams and 1,519,370,970 telephone messages in 1908. The number of parties with telephone connection was 560,016, with 849,784 telephones. The total receipts of the telegraph and telephone departments of Germany, except Bavaria and Württemberg, were $36,250,000 in 1908. About fifty telegraph lines were equipped for duplex operation by means of the Hughes system and 178 telephone lines were also used simultaneously for transmission of telegrams, and 448 telephone lines were equipped for duplex telephony. Of high-speed telegraph systems those of Baudot, Murray and Wheatstone are employed at some places. The Siemens & Halske high-speed telegraph system, using a photographic method, has proven technically efficient, but there is no commercial need at present for such a high-speed system. The central-battery system is gradually finding greater favor in German telephone stations. Wireless telegraphy is making progress. From stations on shipboard it has been possible to transmit wireless messages to a maximum distance of 3700 km (2300 miles) and from stations on land to distances of 5200 km (3200 miles). Automatic and semi-automatic telephone systems appear to find favor at some places where they have recently been installed. Several long-distance telephone lines have been improved by the Pupin system, which has also been employed on a submarine cable of 12 km (7 miles) length. This has now been in operation for four years and has proved very successful. There are also in operation several telephone cables of an aggregate length of 125 km (75 miles) with extra self-induction uniformly distributed all along the line by means of an iron wire spun around the copper inductor.—*Elek. Zeit.,* Oct. 13.

Wave Detectors.—K. BANGERT.—An illustrated translation of his recent German paper. The author discusses the behavior of the electrolytic and the galena detectors, the "tikker" and the coherer, and the various effects produced when one of these is inserted in the oscillatory receiver circuit. He describes experiments which furnish information as to the electrical dimensions of the different elements, and finally briefly summarizes the position as regards the best values to be employed.—Lond. *Electrician,* Oct. 14.

Miscellaneous.

Wood Separators for Storage Batteries.—A note on a recent British patent (25,273, Sept. 29, 1910) of the Tudor Accumulator Company. In order to remove acids and other constituents from wood separators for storage batteries they are treated by a solution of sulphuric acid, or of caustic potash, and afterward washed in water. They are then soaked in a 10 per cent solution of glycerine before drying, in order to prevent warping or cracking.—Lond. *Elec. Eng'ing,* Oct. 6.

Austria-Hungary.—E. HONIGMANN.—An article with tables and diagrams giving data on the electrical import and export trade of Austria-Hungary from 1907 to 1909.—*Elek. Zeit.,* Sept. 22.

Fire Alarm.—J. DOENITZ.—An illustrated description of Schoeppe's automatic fire-alarm system which fulfils the regulations of the Association of German Fire Insurance Companies.—*Elek. Zeit.,* Sept. 29.

Raw Materials for Electrical Industries.—W. FELLENBERG.—In his long serial on the evolution of the electrical industries in the United States and in Germany the author now takes up the discussion of the raw materials used in electrical industries. He discusses the influence which the electrical industry has had on the world's production of raw materials. He gives brief data on water-powers, natural gas, oil, peat and coal, and then discusses the relation of pig-iron and steel production to the electrical industry. The article is to be continued.—*Elek. Zeit.,* Oct. 13.

BOOK REVIEWS.

STATIONARY TRANSFORMERS. Theory, Connections, Operation and Testing of Constant-Potential, Constant-Current, Series and Auto-Transformers, Potential Regulators, Etc. By William T. Taylor. New York: McGraw-Hill Book Company. 169 pages, 107 illus. Price, $1.50.

The statement by the author that "the treatment does not go into the whys and wherefores very deeply, but simply states the facts . . ." is certainly true as far as the "whys and wherefores" are concerned. The author has had a very wide experience in the installation and operation of large high-tension plants in various parts of the world, and this book is reprinted from his notebook. The theory of the transformer is passed through in a hurry, with a word or two about vector diagrams, which is intended for those not familiar with that form of demonstration, but it is feared that the author's explanation of this tool he uses so extensively will give but little light to the uninitiated. Connective details are given very completely. Almost every possible connection of transformers is given, including standard connections for different kinds of circuits, special connections to get certain voltages and phase relations, incorrect connections, etc. Directions for making certain tests are given. This part might be much more complete and a few whys and wherefores would also be acceptable in this chapter. To those interested in transformer connections this book can be recommended. It is very complete, but the explanation is almost entirely by means of vector diagrams, which are left to explain themselves.

THE CORROSION OF IRON AND STEEL. By Alfred Sang. New York: McGraw-Hill Book Company. 139 pages. Price, $1.

This little book sums up in concise language our present knowledge of corrosion of iron and steel. The various theories of corrosion are impartially stated and references given to the works of the original investigators. The effects of physical structure, chemical composition and working environment on corrosion of metal are covered, and methods of inhibition outlined. The book closes with a carefully selected bibliography, compiled from the latest list of the Carnegie Library of Pittsburgh. This book should be of great value as a reference, especially to those who wish to get information quickly. Here they will find the whole subject covered briefly, with full references to the sources. Electrolytic corrosion is treated only incidentally.

DRÄHTE UND KABEL. By H. Brick. Leipzig: B. G. Leubner. 108 pages, 43 illus. Price, 1.25 marks.

The German electrical cables are known the world over for their high quality, and therefore a description of the methods of manufacture should prove interesting as representative of the best European practice. This book covers the manufacture of cables in a descriptive way, from the raw material, through the different manufacturing processes to the point where the cables are ready for use. The methods described are those used by the leading cable makers of Germany. The properties of cables, theory of operation and technical data are not included in this work, which is practically limited to a description of cable manufacture.

Fowler's Mechanical Engineer's Pocketbook. 1910. Twelfth edition. By William H. Fowler. Manchester: Scientific Publishing Company. 650 pages. Price, 2s. 9d.

This book, while particularly adapted to British conditions, contains much information of such character as to be useful here as well. The scope is such as to interest the power-plant operator. More than three-fourths of the contents are devoted to power-plant equipment, such as boilers, engines, steam turbines, gas producers and engines, condensers, pumps, cranes, etc. In this connection the properties of fuels (coal, gases, oils) and steam are discussed and rules given for the guidance of the operator in the use of fuels and power-plant equipment.

New Apparatus and Appliances

METER PROTECTIVE AND TESTING DEVICES.

Various electric light companies have adopted with excellent results many of the devices now on the market which facilitate the installation, testing and replacing of meters, and above all make them proof against theft of electrical energy. The accompanying illustration, Fig. 2, shows the application of meter connection and protective blocks to modern apartment house service installations. The illustration tells its story best when compared with Fig. 1. The latter shows the ordinary arrangement of meters in one part of the basement of an apartment house, while Fig. 2 shows the arrangement in the new part of the basement in the same apartment house. The temptation open to unscrupulous persons to tamper with the circuits in the arangement shown in Fig. 1 is entirely lacking in the arrangement shown in Fig. 2. The line wires are protected from illegal manipulations when the meter is in use and when the meter is removed for any cause the open end of the cabinet may be closed with a disconnected service strap, making it necessary to break a seal to get at the service wires. In addition to the above advantages the porcelain test and terminal block forming part of the outfit facilitates the work of the meter tester so that from 30 per cent to 50 per cent more meters can be tested in a given time. In testing, not only are wrong connections impossible, but the customer's service is not interfered with. Fig. 3 illusrates a meter under test.

In Fig. 2 a universal meter box is shown, the base or main part containing the indicating snap switch and combination porcelain fuse and testing block, and the trim or cover enclosing and protecting the service connections and the terminals of the meter. These trims are built for any make of meter and all fit the same base. This permits one to change from one type of meter to another very quickly, a feature which will be appreciated by those who have to change a bottom-connected meter with two wires in and two wires out, with service entrance are connected. The service mains enter the sealed iron box shown in the center of the engraving containing a main switch

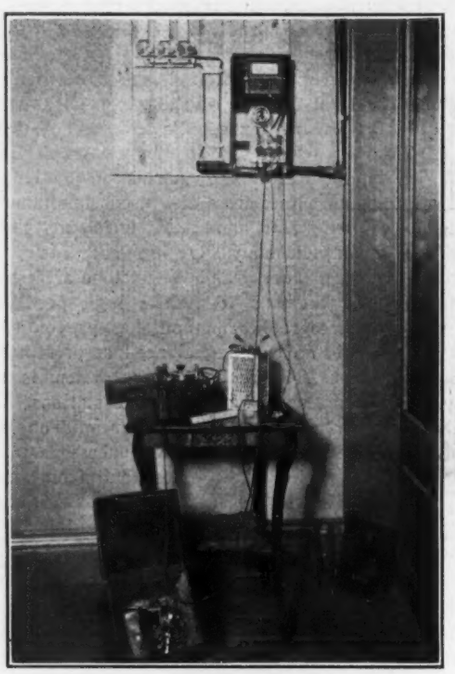
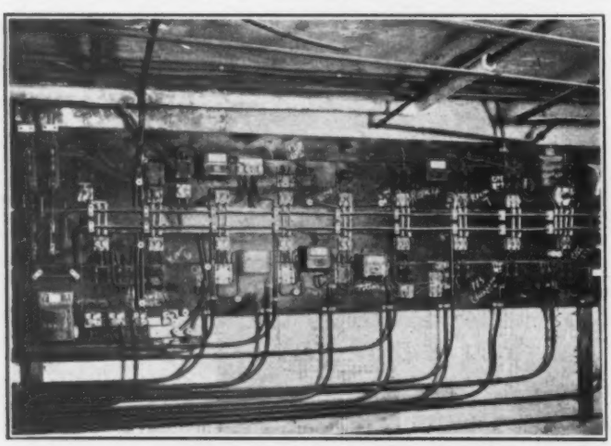


Fig. 3—Meter Under Test.

and fuse and pass thence to the bottom of the boxes. There is not a wire visible; each customer has his own fuse and



Figs. 1 and 2—Apartment House Meter Equipment Without and With Protective Devices.

on the left-hand side, to a meter of the shunt type, top connected, with service entrance on the right-hand side, or vice versa. The illustration shows how a large number of meters switch, and there is no possible chance for tampering with the circuits. The Hart Manufacturing Company, of Hartford, Conn., is the maker of the protective and testing devices shown.

ORNAMENTAL ARC LIGHTING.

An interesting installation of display lighting by arc lamps in Milwaukee, Wis., is made by the Milwaukee Electric Railway & Light Company. The Public Service Building, which is occupied entirely by this company and covers about one square block, is surrounded by a number of General Electric enclosed-arc lamps on ornamental poles. The poles are spaced very closely and three lamps are hung on each one. The type of pole used is of similar design to the ones that have been adopted by the City of St. Louis, the only difference being a slight change in the ornamental base.

The night photograph reproduced herewith indicates the brilliant illumination, in which there is an absence of shadows.

Display lighting of this character has a distinct advertising value with a direct financial return. That the appreciation of this fact is not confined to electrical companies is well demonstrated in St. Louis, Mo., and Toledo, Ohio, where some time ago the merchants paid for the installation of luminous-arc lamps mounted on ornamental poles and are now rapidly extending this system so as to embrace all of the business districts. Arc lamps hung on ornamental poles make an ideal combination, not alone on account of the economical operation, but because of the brilliancy at night and artistic appearance in the daytime.

Figs. 1 and 2—Day and Night Views of Ornamental Street Arc Lighting in Milwaukee, Wis.

MOTOR-DRIVEN MACHINES FOR MUTILATING DEFACED BILLS IN CHICAGO SUB-TREASURY.

Motor-driven installations are notably cheap to operate, but probably the most expensive 3-hp outfit in the West, when running at full capacity, is one at the corner of Adams and Clark Streets, Chicago, which sometimes consumes as much as $600,000 daily. The site mentioned is that of the Chicago Sub-Treasury, and the machinery installed is for the purpose of mutilating and chopping old banknotes and currency, which are then shipped to Washington, where they are again checked and compared and finally macerated into finely ground pulp.

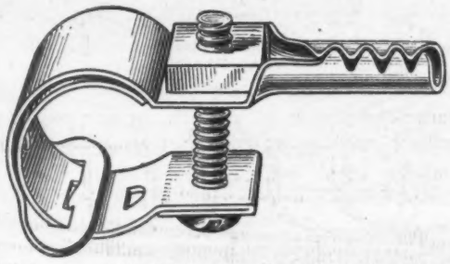
The machinery used in the mutilating and chopping operations at Chicago comprises a 2-in.-stroke punch press belt-driven by a ⅛-hp Westinghouse motor, and a 36-in. Sheridan paper knife, belt-driven by a 2½-hp Westinghouse motor. The soiled and damaged currency returned by the banks is first counted and stacked into bills of similar denominations. These bills are then put through the punch press, where two Keystone-shaped holes are punched near the end of each bill. This Keystone-shaped hole is the designation of the Chicago Sub-Treasury; that at New York uses a crescent shape, and each of the other sub-treasuries has its individual design for identifying the bills canceled by it. After being mutilated by the punch press the bills are taken to the paper knife, where they are cut into lengthwise halves, each of which contains a punch mark. The upper halves of these bills are then forwarded to the Treasury at Washington, while the lower halves are sent the following day, rendering it impossible to match and use the parts from any shipment, even if the telltale punch holes were repaired.

Heretofore the transportation of the soiled money to Washington has been done by the express companies, the bills being sent intact, but the authorities have now decided that expense will be saved by chopping the bills at the sub-treasuries and sending the parts to Washington by registered mail. In this way the Post Office Department will receive the payment for carrying the defaced bills, although the amount thus earned will be less than that which has hitherto been charged by the express companies.

The mutilating machinery in the Chicago Sub-Treasury has been installed and operated under the direction of Assistant Treasurer Boldenweck, whose office destroys from $100,000 to $600,000 each working day and returns it to the Treasury at Washington.

ADJUSTABLE GROUND CLAMP.

The ground clamp illustrated herewith is made of copper in two parts and interlocked together so that it makes a permanent contact when fastened to the pipe with screw and locknut. To adjust it to the pipe the only tool necessary is a screwdriver. The lug for the wire is notched and tinned to permit the free flow of solder, and when it is squeezed together it forms a solid joint. The device is made in two sizes; the smaller fitting pipes from ⅜ in. to 1 in. in size and the larger fitting pipes from 1¼ in. to 2 in. in size. The American Metal Works, Germantown, Philadelphia, Pa., manufacture the clamp.



Adjustable Ground Clamp.

TIME-SAVING PIPE WRENCH.

The Wright Wrench & Forging Company, Canton, Ohio, is placing on the market a new pipe wrench, illustrated herewith, known as the "Stover pipe wrench." It is a quick-adjustable wrench, with an automatic grip that cannot flatten the pipe and has an instant release which with the automatic opening makes it impossible to lock on a pipe. It requires but one hand instantly to adjust it to any size pipe and one can get a firm and positive grip the first trial, which is stated to be impossible with any other adjustable pipe wrench. The advantages of a pipe wrench which can be adjusted and operated with one hand will readily be appreciated by pipe fitters, who frequently work

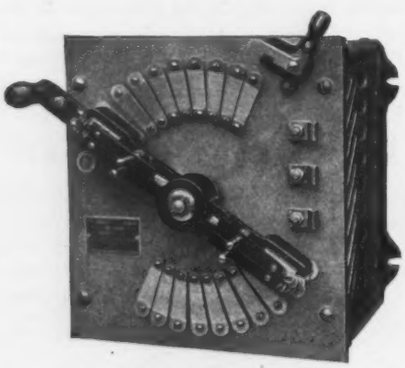
Adjustable Pipe Wrench.

in dark and insecure places where it is necessary to hold a lamp or grasp some object for support.

The 14-in., ¾-lb. Stover pipe wrench is stated to be lighter than any other pipe wrench on the market, and 25 per cent stronger, and will grip any pipe from ⅛ in. to 1½ in. The arc on which the jaw moves gives it an automatic grip on any size pipe within the range of the wrench and with an instant release. The wearing parts are all interchangeable and can be easily replaced at the expense of a few cents. The grip is the only part to wear out on this wrench. There are no screws or pivot pins such as are used in wrenches of the overhanging-bar type.

STARTING RHEOSTATS FOR ALTERNATING CURRENT MOTORS.

The increased use of alternating-current motors in the industries has created a demand for suitable and inexpensive starting apparatus. Motors of large capacities were first employed



Starting Rheostat.

as substitutes for other prime movers, but now motors of moderate size have come into extensive use also. The cost of starting apparatus is usually greater proportionally for small motors than for larger units, however, and the practice of throwing these motors directly across the lines causes disturbances and other undesirable effects.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has recently developed new devices for use with alternating-current motors, the starter illustrated operating in the same manner as the Cutler-Hammer direct-current motor-starting rheostat of the sliding-contact type.

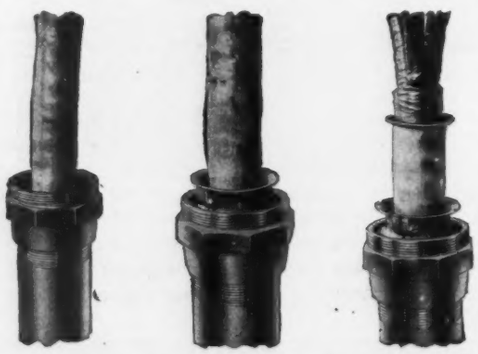
This face-plate-type of starter is for use with two-phase or three-phase slip-ring induction motors. It is convenient, compact and easily operated, and can be mounted on the wall or other handy location. The resistors are mounted on the rear of the face and no extra wiring is, therefore, needed, as is the case where the resistors are mounted separately. The only wiring required is to connect the slip rings of the motor to the three terminals on the face plate.

The contact segments are of hard-drawn copper and can be easily replaced or interchanged without interfering with any interior connection. The resistors conform to the requirements of the underwriters, being of the grid type for all except the smallest sizes, on which the tube type is used. The bushes consist of a pair of contacts at each end of the lever. The leading contact of each pair is made of carbon, while the other is made of copper. This results in long wear, as the carbon takes the arc, while the copper, which has a low contact resistance, carries the current.

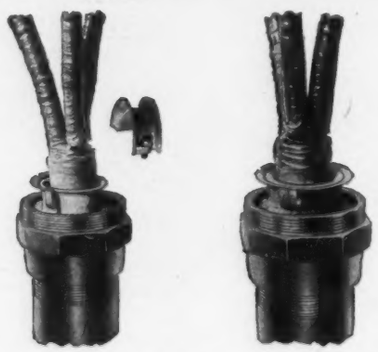
A latch is provided for holding the lever in the running position, but this can be replaced if desired by a no-voltage release. In case of the current failing, the primary circuit is automatically opened and the rotor resistance reinserted. An overload attachment can also be provided to open the primary circuit and cut in the resistance in the secondary when the motor is overloaded. These starters, which are made in capacities ranging from 3 hp to 50 hp, are designed to make more satisfactory the use of alternating-current motors of corresponding capacities and extend their satisfactory application.

NEW CABLE-END BELL.

The Electrical Engineers' Equipment Company, of Chicago, manufacturer of power-station specialties, has recently brought out an improved type of cable-end bell which is worthy of attention. The new device consists of a cable-end bell so arranged that the cable sheath is grounded at the extreme end



Figs. 1, 2 and 3—Cable-End Bell in Process of Application.

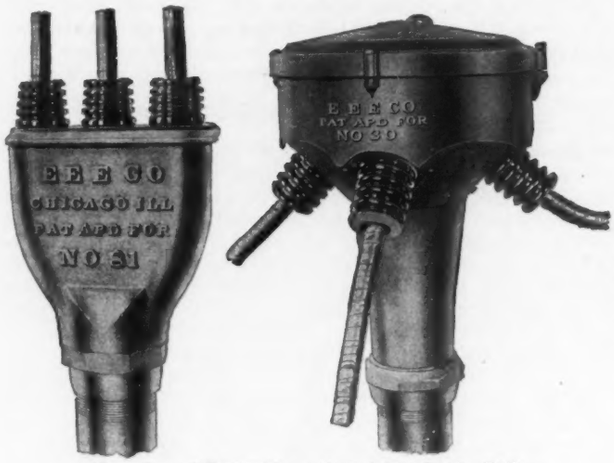


Figs. 4 and 5—Cable-End Bell in Process of Application.

on the cable and on the inside of the bell. The accompanying illustrations show how this operation, which is a simple one, is accomplished. The use of an inside clamp ring permits of cable bells being placed in position, and the cable installed,

in from thirty to forty-five minutes, including the melting of the insulating compound and the filling of the bell with it.

As shown in the cuts, the new type of bell is so arranged that it may be screwed on top of a pipe of any description. The company also manufactures, however, a complete line of cable-end bells with a clamp below or outside of the cable bell for use on cable which is not protected by iron pipe. The



Figs. 6 and 7—Inside and Outside Cable Bells.

advantage of providing a cable bell which eliminates the expense of wiping joints is obvious. The simplicity of this method of protecting a lead-covered cable of any voltage is shown by the illustrations.

Fig. 1 shows the polygonal iron coupling screwed on the protective pipe with the cable pulled through. Fig. 2 shows the inside brass clamp ring slipped over the cable and screwed down into the polygonal bushing. In Fig. 3 the lead sheath is peeled off the cable and the sheath is belled out to fit the clamp ring. The belled-out cable is shown above the clamp ring. Fig. 4 represents the cable sheath belled out and in proper position on the clamp ring, the latter being screwed out for the purpose of forming a good contact. Fig. 5 shows the cable in proper form and completed ready for the cable-bell casing to be screwed on the polygonal coupling. The clamp ring is here shown tightened up into place. Fig. 6 shows a complete cable bell designed for inside service. The outside casing is here shown screwed into place on the polygonal coupling; the leads have been brought out, and the bell has been filled with compound. Fig. 7 indicates how the method shown in Figs. 1 to 5 may be applied to any cable bell manufactured by the company. The cable bell shown in Fig. 7 is for outside service.

The accompanying illustrations are devices for conditions encountered in an actual working installation. The cable shown carries 13,200 volts working pressure, and the system was tested complete, with more than eighty cable bells in place, at 32,500 volts for five minutes. No trouble developed in any of the bells. All the bells made by the Electrical Engineers' Equipment Company are guaranteed for five years' service, and each one is tested to two and one-half times the working voltage for which it is designed. The outside cable bells are all subjected to a wet test corresponding to 1 in. of rain in five minutes, and are likewise tested to two and one-half times the working voltage.

LARGE CANDLE-POWER TUNGSTEN LAMP INSTALLATION.

The recently developed tungsten lamps rated at 500 watts and giving approximately 442 cp are economical substitutes for other lighting units of high candle-power and clusters of small lamps of low candle-power. While they give the large volume of light of the arc lamp or a cluster of small incandescent lamps, they have the simplicity, reliability and convenience of the ordinary incandescent lamp of lower candle-power.

There are many advantages inherent in this type of lamp. The light is steady, with an entire absence of flickering. When the light is turned on the full intensity is attained at once without the delay associated with the "feeding" of arc lamps. There is no deterioration in the quality of the light, it being the same during the whole life of the lamp. The lamp requires neither trimming nor attention, and consequently involves no operating expense. Moreover, the maintenance cost is low.

They can be used to advantage for lighting department stores, store fronts, show windows, billboards and for the general lighting of large interiors, such as auditoriums, armories, skating rinks, factories, yards, streets, etc.

The accompanying illustration shows a part of the book department of Hahne & Company's department store illuminated by 500-watt General Electric "Mazda" tungsten lamps in Mono-

Department-Store Lighting by Large Incandescent Lamps.

lux units. These large fixtures, suspended from the ceiling by ornamental brass hooks and chains and fitted with large iridescent globes and shades with pearl-like reflecting surface, add greatly to the attractiveness of the store. They produce a particularly soft and well-diffused light, which harmonizes with the ornamental effect and makes the illumination agreeable as well as attractive. They also harmonize with the other incandescent lamps in the store.

The height of the ceiling above the floor is 17 ft. 11 in., and the lamps are suspended 14 ft. 5 in. from the floor. The ceiling, posts and wall are white. It is said that the lamps have been in service for 1250 hours and as yet there has been no burn-out of lamps.

Industrial and Commercial News

The Week in Trade.

While the volume of business is still below normal, reports last week indicated that there was some quickening in demand both with the jobbers and retailers. This is attributed largely to the improvement in weather conditions and the stimulating effect the touch of winter throughout the West has had upon buying. The number of orders received by the jobbers is not yet sufficient to cause much enthusiasm, and individually the orders are much smaller than usual, showing that buyers are still very conservative, but the reawakening of hope is in itself encouraging. In the leading industrial lines there is not much improvement to be noted. The iron and steel mills are fairly busy, but new orders are not being received in sufficiently large volume to promise much for the future. The demand for structural material is not nearly so active as it was a few months ago, and while there are many rumors of heavy specifications being prepared by the railroads for rails and equipment the actual orders have not yet been placed. The condition in the textile industry is still unsatisfactory, due, especially in the case of cotton goods, to the uncertainty and irregularity in the price of raw material. The excellence of the crop returns and the early movement to market have supplied the agricultural sections with a liberal amount of money and this has done much to stimulate collections. These are greatly improved. Business failures, for the week ended Oct. 27, as reported by *Bradstreet's*, were 220, as compared with 197 the previous week, 217 in the same week of 1909, 241 in 1908, 223 in 1907, and 163 in 1906.

The Copper Market.

Copper declined rather sharply in the New York market during the past week, and there were also some recessions in the European market. This was in a measure due to the withdrawal of speculative activity. It also may be, to some extent, attributed to the fact that consumers in this country bought about all that was required for their immediate needs in the early part of the month of October. The business of the electrical manufacturing concerns and also of the brass manufacturers is hardly up to normal, and it has been the policy of all of these concerns to buy only sufficient copper to cover orders that have been already placed. There seems to be absolutely no disposition on the part of any consumers to lay up stocks for future business. On this account there is always a recession when speculative activity ceases. During the past week offerings of lake and electrolytic copper were made quite freely at concessions from quoted prices. The copper market is in a measure, however, strengthened by the general belief that the next report of the Copper Producers' Association, which will be made public about Nov. 10, will show a very considerable reduction in the production of metal, and will probably show a considerable reduction in the surplus stocks now on hand in this country. This will be accomplished without adding any great amount to domestic takings. One copper authority figures that the present rate of production in the United States, Canada, Mexico and South America is about 108,000,000 lb. per month, whereas before the curtailment policy was put into effect the rate of production was about 125,000,000 lb. per month.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.30	12.50	.....
November	12.30	12.50	12.40
December	12.30	12.50	12.40
January	12.30	12.50	12.40

The London Market Oct. 31 was as follows:

	Noon.			Closing.		
	£	s	d	£	s	d
Standard copper, spot	57	1	3	57	0	0
Standard copper, futures	58	2	6	58	1	3

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	13.50			11.70		
London, spot	£62	0	0	£52	15	0
London, futures	65	18	0	53	7	6
Best selected	65	10	0	57	15	0

Exports for October have been fairly large and imports have not been as heavy as they were several months ago. The total exports for the month, including Oct. 31, were 24,261 tons. The daily call on the Metal Exchange Oct. 31 quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

Rapid Transit Bids.—The Public Service Commission of the First District of New York received seventy-seven bids last week for the construction of the tri-borough subway system by city money. Every one of the twenty-one sections offered in the proposals received at least one bid. Many of them received quite a number. The Bradley Contracting Company put in a lump bid for the entire construction of $93,000,000. Quite a number of other construction companies bid upon several sections. S. Pearson & Sons, of London, the contractors who constructed the Pennsylvania Railway tunnels into New York, put in bids for that portion of the work which carried the proposed subway under the Harlem River. The tabulation of the bids requires a considerable amount of time and no definite statement can be made at present as to the lowest bidder. When proposals to construct a subway by private capital were asked for, to be opened Oct. 20, the Public Service Commission did not receive a single bid.

United States Light & Heating Company.—The new Buffalo plant of the United States Light & Heating Company is now practically finished, and operations in it are expected to begin next week. The plant has cost over $400,000, and has been paid for, with the exception of about $40,000, entirely from the working capital or current earnings. Ultimately this balance will be paid for from the net profits. It is understood that at the present time the company has about $500,000 cash on hand, and nearly $650,000 of bills receivable. It is said that there has been a persistent buying of both preferred and common stocks of the company, and it is also reported that ultimately the par value of the stock will be changed from $10 to $100 and the stock will be listed on the New York exchange.

Proposals for Electric Machinery for Navy.—Sealed proposals will be received until Dec. 3 at the Bureau of Yards and Docks, Navy Department, for a 75-kw motor-generator set with wiring complete for the power plant at the United States Naval Station at New Orleans, La. Until Nov. 12 the Bureau of Yards & Docks, Navy Department, will receive sealed proposals for one electrically-driven (alternating current) capstan to be installed at the New York Navy Yard, capable of developing and sustaining a rope pull of not less than 35,000 lb. at a speed of 12 ft. per minute or a pull of 1400 lb. at a speed of 30 ft. per minute.

Duty on Tungsten Lamps.—According to a recent ruling of Collector of Customs Loeb, tungsten lamps are to be assessed at 45 per cent ad valorem under the head of manufactured articles wholly or in part of metal. It was claimed by the importing company, the Electrical Accessories Company, that the merchandise is dutiable at 25 per cent as tungsten metal, since the chief value of the lamps lies in the metal used. The protest of the importer has been overruled and the collector's decision affirmed by the Board of United States General Appraisers.

Association of Sales Managers.—C. A. S. Howlett, president of the National Association of Sales Managers, and sales manager of the General Electric Company, addressed a meeting of the Sales Managers' Association of Cincinnati recently on "The Objects of Our Association." He stated that the aim of the organization is to reduce the selling of merchandise to a science, governed by fundamental principles and natural laws, the same as any other science. Walter A. Knight talked on "Unfair Competition" and reviewed a number of supreme court decisions on trademark and patent litigation.

Pennsylvania Storage Battery Company.—A company was incorporated in Delaware last week called the Pennsylvania Storage Battery Company and given the authorization to manufacture and deal in storage batteries. The incorporators were F. R. Hansell, George H. B. Martin and S. C. Seymour. The authorized capitalization of the company is $400,000.

Western Power Company Lease.—Negotiations have been practically concluded providing for the lease of the Western Power Company, of California, by the Pacific Gas & Electric Company. According to the terms of the lease, which are so nearly settled that a semi-official announcement of them has been made, the lease will be operative for forty-six years. The rental that will be paid by the Pacific Gas & Electric Company will be 2½ per cent on the $18,000,000 of outstanding stock of the Western Power Company during the years 1912 and 1913. In the year 1914 the rate will be 3 per cent, and the rental will increase ½ per cent yearly until the rate reaches 7 per cent, the latter figure to stand until the expiration of the lease. It is specifically provided in the lease that all further moneys expended in developing the hydroelectric plants now owned by the company shall be figured in the capitalization, and shall receive the benefits of the lease percentages. The Western Power Company owns the entire capital stock of the Great Western Power Company, amounting to $25,000,000. The latter is the concern which has developed the large hydroelectric plant on the north fork of the Feather River, Cal., which is now selling energy to Oakland and San Francisco. The company also owns two enormous hydroelectric propositions at Big Meadows, Cal. The engineers estimate that if all of the water-power controlled by the company is developed the output will amount to 430,000 hp. The Great Western company also owns, through the California Electric Generating Company, a large steam turbine plant on the waterfront at Oakland. The Western Power Company has already, under a selling contract, been furnishing the Pacific Gas & Electric Company with energy. The latter company practically controls the market in the San Francisco district for all electrical energy not used for traction purposes. The Great Western plant was described in the *Electrical World* in the issues of Aug. 26, Sept. 16 and Sept. 23, 1909.

Slump in Rubber Prices.—Prices for crude rubber are still declining and the market is distinctly weak. Trading is dull, as there is a widespread belief among consumers that further declines are probable. Some users of rubber declare that up-river Para, which is now selling at $1.35@1.37 a pound, will sell for $1 or less before the end of the year. Other grades of rubber are correspondingly depressed, Africans selling for $1.10@1.15 and guayule at 60@70 cents. In connection with this latter decline a correspondent from Torreon, Mexico, writes: "The guayule rubber industry in northern Mexico and southwestern Texas is showing the depressing effects of the recent slump in prices of the shrub and the manufactured product. The guayule shrub, which was selling for $300, Mexican money, or $150 gold, per ton a few weeks ago, is now bringing only $150 Mexican money, or $75 gold, per ton. Some of the independent rubber factories which have large outstanding contracts with land owners to buy at prices ranging from $200 to $300 per ton are uneasy over the situation. It is claimed by these that there is no justification for the sudden drop in prices, and the charge is being made that it is an effort on the part of the Intercontinental Rubber Company to force the sale to it of the independent rubber factories and guayule lands. In this connection it is stated that the independent guayule rubber interests of Mexico have appealed to the Mexican federal government for relief. It is urgently requested by them that the government shall make an investigation of the causes for the recent slump in prices of the shrub and the manufactured produce. It is claimed that the Intercontinental Rubber Company practically controls the industry and that it has enough guayule shrubs upon its own lands to keep its factories running for several years; also that it is storing its stocks of crude rubber as fast as manufactured and that the supply is now being received wholly from independent sources."

Westinghouse Lamp Company.—The plant of the old Sawyer-Man Company, located at 510-532 West Twenty-third Street, which was abandoned by the Westinghouse Lamp Company in April, 1908, has been re-equipped by that company as its tungsten lamp factory. The fact that this would be done was published in our issue of June 23, 1910. The equipment of this factory will increase the output of tungsten lamps of the Westinghouse company by about 10,000 lamps per day. The plant is to manufacture exclusively 25-watt, 40-watt and 60-watt, wire-type tungsten lamps. These lamps are made with one length of filament from one leading-in wire to the other, with a positive electrical connection between the filament and the leading-in wires. The joint is protected by wrapping the filament around the leading-in wires, thus insuring flexibility and eliminating points of rigid contact in the lamp. Due to this construction and the improvements in the method of making the filament it is claimed that fragility of the lamp, which was the most serious objection to its general adoption, is to a great extent overcome. The lamp being constructed by an entirely new process, it was necessary to develop and manufacture new machinery for the equipment of this plant, which machinery is entirely of American design, and it is stated that the starting of the plant marks the separation of American apparatus from the modified European apparatus which has heretofore been made to fit American conditions. The factory itself is organized on new lines which are quite a departure in lamp manufacture, in that it is made up of a number of individual factories, each independent of the other and all operating in one plant.

New York Telephone Company Proposal.—A proposal has been made to the Board of Estimate in New York City by the New York Telephone Company offering a new schedule of rates in return for an absolute monopoly in the city. The company offers to furnish the city service at 50 per cent reduction from its regular schedule of rates; to adjust periodically the rates accorded the public; to limit its net earnings to 10 per cent on the capital actually invested less depreciation and to pay to the city $116,000 a year for the first five-year period, $176,000 for the next five years and $200,000 a year thereafter. It will also file an annual statement with the Comptroller. Practically the same offer was made to the city in 1906, but the Corporation Counsel held at that time that its acceptance might validate certain franchises which were then in dispute.

Apparatus for Clinchfield Coal Company.—Ford, Bacon & Davis, New York, engineers, have just closed a contract with the Westinghouse Machine Company for two 1000-kw turbine, Le Blanc condensers; ten 300-kw, 6600-250-volt, 60-cycle motor generators, switchboard, wiring and all electrical auxiliaries for the Clinchfield Coal Company, of Dante, Va. The firm is also asking in behalf of this company for bids for boilers, stacks and feed pumps. The electrical system will consist of a power station and four substations, with power distribution at 6600 volts within a radius of about six miles from the power station. The work is in connection with large coal developments in Virginia.

Old Municipal Arc-Lighting Apparatus to Be Disposed Of.—Owing to the fact that electrical energy procured from the Chicago Drainage Canal plant of the Sanitary District is now used by the City of Chicago for street lighting, the city finds itself in possession of considerable arc-lighting station equipment at its municipal plants for which it has no use. Accordingly the City Council has authorized the city controller, with the advice of the city electrician, to advertise for bids for the sale and removal of this superseded apparatus, consisting of boilers, condensers, steam engines, piping, shafting and a number of arc generators. Bids must be submitted in writing and must be sealed.

Chicago Office Buildings on Central Station Mains.—In its advertising announcements the Commonwealth Edison Company of Chicago says that more than two-thirds of the office buildings in that city are supplied with electricity from the mains of the Commonwealth company. It is asserted that the owners buy the electricity at less cost, delivered, than it can be produced by private plants. It is pointed out also that the abandonment of private plants has much to do with abating the smoke nuisance.

European Inquiry for American Electrical Machinery.—An American consul in Europe reports that a local business firm desires to receive addresses and catalogs of American manufacturers of heating and lighting installations. The consul also sends the names and addresses of other firms in his district to which similar trade literature should be sent. The various addresses may be obtained from the Bureau of Manufactures, Washington, the file number being 5699.

United States Treasury Proposals for Electric Light Fixtures and Wiring.—Sealed proposals will be received at the office of the supervising architect, United States Treasury Department, Washington, for the installation of electric light fixtures and wiring in post office buildings as follows: Lancaster, Ohio; Athens, Ohio; Brunswick, N. J.; New London, Conn.; Salisbury, N. C.; Davenport, Iowa; Houston, Tex.; Lake Charles, La., and Toledo, Ohio.

The Marion Electric Light & Street Railway Company, of Marion, Ill., has changed its name to Marion Light, Power & Water Company and increased its capital stock from $20,000 to $100,000.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Centralia, Wash.; New Braunfels, Tex.; Buckhannon, W. Va.; Monticello, N. Y.; Georgetown, Tex.; Livingston, Tex.; Providence, R. I.; Brainerd, Minn.; Elba, Ala.; Clayton, N. M.; Forest Grove, Ore.; Olivet, Mich.; Lexington, Va.; South River, N. J.; New York, N. Y.; Buffalo, N. Y.; Concord, N. H.; Cedars, Miss.; Humboldt, Tenn.; Clarksville, Tex.; Cleveland, Ohio; Carson City, Nev.; Pine River, Minn.; Orillia, Ont., Can.; Texas City, Tex., and Spokane, Wash.

Fremont (Neb.) Gas & Electric Light Company.—The Fremont Gas & Electric Light Company has just purchased a cross-compound engine direct-connected to a 300-kw generator, which will be installed in the company's steam station at Fremont.

Financial.

The Week in Wall Street.

EVERYBODY understands that it has been a hard struggle for the bull leaders and for those behind the upward movement to keep the stock market from declining during the past week. With the advance in prices there was a great desire on the part of small speculators and also on the part of some investors to sell out when there was a profit in sight. This disposition is responsible for the reactions that were reported last week and also for the failure of the bull campaign to succeed in pushing the market upward. As far as the sentiment of Wall Street is concerned and as far as practical news features that have developed within the past fortnight are concerned, there is nothing to stimulate a very active bull market, and there is nothing to cause any serious depression. Aside from the fact that the United States Steel Corporation made a report for the third quarter of 1910 which showed that it had on its books Sept. 30 a smaller amount of orders than ever before at the end of any quarter since the reports were made, there has been no news that would tend to discourage the average investor or speculator. Even this report is largely discounted by the fact that the earning figures in the same publication show that the corporation has earned far more than its dividend obligations during the quarter. It is also true that the bond market at the present moment is not so good as a month ago. With a revival of interest in stocks, there seems to occur a loss of interest in bonds. The money market at the present time is not causing any serious trouble, but no one is sure as to what may happen. Foreign banks have advanced the rates of discount, and it is not believed that cheap money can continue to be available in this country when high bank rates are paid abroad. Call money Oct. 31 was 3½ a 4 per cent; 90 days, 4½ a 5 per cent. The quotations in the accompanying table are those of the close Oct. 31.

NEW YORK.

	Oct. 24	Oct. 31	Shares sold		Oct. 24	Oct. 31	Shares sold
All.-Ch.	10	9¾	400	Int.-Met., pfd.	59	57¼	72,800
All. Ch., pfd.	33	32¼	400	Mackay Cos.	92	91*	600
Amal. Cop.	69½	69⅛	118,900	Mackay C., pf.	75½*	74*	300
Am. D. T.	20½	20½*	———	Man. Elev.	143*	142⅛*	800
Am. Loc.	40½	39¾	2,450	Met. St. Ry.	15*	15*	———
Am. Loc., pfd.	106*	106⅛*	145	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel & C.	84*	84*	———	Steel, com.	78⅛	78¼	1,022,000
Am. T. & T.	138¾	141	19,200	Steel, pfd.	119¼	117⅜	5,330
B. R. T.	77¾	76⅞	27,155	W. U. T.	72	72	952
Gen. Elec.	154¼	154	6,430	West'h, com.	73	72¾	7,030
Int.-Met.	23⅛	22	61,210	West'h, pfd.	124*	124*	———

PHILADELPHIA.

	Oct. 24	Oct. 31		Oct. 24.	Oct. 31.
Am. Rys.	43*	43*	Phila. Elec.	15¾	15½
Elec. Co. of A.	11⅝*	11⅝*	Phila. R. T.	16⅜	16
Elec. St. B'ty.	49	49*	Phila. Trac.	82*	81
E. S. B'ty, pfd.	30*	30*	Union Trac.	39	39⅝

CHICAGO.

	Oct. 24	Oct. 31		Oct. 24.	Oct. 31.
Chi. City Ry.	160	170*	Chi. Tel. Co.	122½	120*
Chi. Rs., Ser. 1.	75*	79	Met. El. Co.	21*	21*
Chi. Rs., Ser. 2.	18⅞	21	Met. El., pfd.	65*	61*
Com. Edison	116	114¾	Nat'l Carbon	128	145
Chi. Subways	5	5	Nat'l Car, pfd.	119½*	119*

BOSTON.

	Oct. 24	Oct. 31		Oct. 24.	Oct. 31.
Am. T. & T.	138⅞	141	Mex. Tel.	5¾	5¾*
Cum. Tel.	143*	143*	Mex. Tel., pfd.	6	6*
Edison E., Ill.	266	267½	N. E. Tel.	135½*	136
Gen. Elec.	154⅛	154	W. T. & T.	19*	17*
Mass. E. Ry.	19¾	19¾	W. T. & T., pfd.	90*	89*
Mass. E. Ry., pfd.	84¾	84¾			

*Last price quoted.
Shares sold for week Oct. 24 to Oct. 29.

Financial Notes.

Vacuum Cleaner Companies Merged.—The stockholders of the McCrum-Howell Company met at Norwich, Conn., last week, and authorized an increase of the company's capital stock from $4,000,000 to $7,000,000. The capitalization of the company will consist of $3,500,000 common and $3,500,000 preferred. The directors also met and declared a special dividend of 50 per cent on the common stock, payable Jan. 30, and the usual quarterly dividend of ¾ of 1 per cent on the common stock, payable Jan. 1. It is given out that about half of the additional capital stock will be used for the acquisition of five competitive companies in the boiler, radiator and vacuum-cleaner business. The companies to be taken over are the Model Heating Company, of Philadelphia and New York; the Cameron-Schroth-Cameron Company, of Chicago; the American Air Cleaning Company, Milwaukee; the Vacuum Cleaner Company, of New York, and the Sanitary Devices Company, of San Francisco. The acquisition of these companies will give the McCrum-Howell Company control of about 80 per cent of the stationary vacuum-cleaning business.

Cities Service Company Stock.—Henry L. Doherty & Company, 60 Wall Street, are offering for sale $1,000,000 par value of the preferred and $350,000 par value of the common stock of the Cities Service Company. This is the holding company recently organized by Doherty & Company to take over the control and ownership of 90 per cent of the stock of the Spokane Gas & Fuel Company, Denver Gas & Electric Company and the Empire District Electric Company, of Joplin, Mo. The authorized capitalization of the Cities Service Company is $30,000,000 of 6 per cent cumulative preferred and $20,000,000 of common. There is now outstanding $8,779,650 of preferred and $4,889,825 of common. The offer of Doherty & Company is $100 par value preferred and $35 par value common for $100. Claude Meeker, a dealer in public utility securities at Columbus, Ohio, is also sending out circulars advertising the stock of the Cities Service Company. Mr. Meeker's offer is $84 for preferred and $64 for the common.

White River Light & Power Company.—Ralph H. Beaton, receiver of the White River Light & Power Company, of Noblesville, Ind., is offering the property of the company for sale under foreclosure Nov. 19. The sale will take place at Noblesville. The property consists of a hydroelectric site on the White River, with a concrete dam in process of construction, power plant already completed and some outside buildings; sufficient land along the banks of the White River to provide for the backing up of the water; transmission lines to Noblesville, and various other fixtures and construction machinery.

Rehearing on Third Avenue Reorganization Plan.—The Public Service Commission of the First District of New York has granted a rehearing upon the plan for reorganizing the Third Avenue Railroad Company proposed by the bondholders. This plan was rejected by the commission July 29 after months of hearings. The application for a rehearing was made as a preliminary to appealing to the courts from the commission's decision. The application for the rehearing was based on the allegation that the commission had erred in its valuation of the property.

Independent Electric Company, Forest Grove, Ore.—The recently incorporated Independent Electric Company, of Forest Grove, Ore., has purchased the plants and holdings of the Haines Light & Power Company, of the same city, and the Hillsboro Water, Light & Power Company, which controls a hydroelectric plant about sixteen miles from Forest Grove. The Independent Electric Company has a capital stock of $100,000. It contemplates extensive improvements and extensions to the plants it has just bought.

Atlantic Shore Line Railway Company.—A decree has been entered by the United States Circuit Court at Portland, Maine, ordering the sale Dec. 1 of the Atlantic Shore Line Railway Company, of Sanford, Maine. The foreclosure suit was brought by the Knickerbocker Trust Company, of New York, trustee for $1,191,500 5 per cent bonds. The railway extends from Portsmouth, N. H., to Biddeford, Maine, and has 94.9 miles of track.

Columbia Gas & Electric Company.—Arrangements have been made by the Columbia Gas & Electric Company, of Cincinnati, for the immediate sale to an English syndicate of $1,000,000 5 per cent bonds, and for the future sale of a like amount. The price received for these bonds is said to be about 85.

Central Maine Power Company.—Perry, Coffin & Burr, of Boston, are offering for sale a limited number of the thirty-year 5 per cent bonds of the Central Maine Power Company, of Waterville, Maine. The bonds are offered at 98½ and interest. These bonds are a legal investment for the savings banks of Maine. The Central Maine Power Company does lighting and power business in the Kennebec Valley, serving the cities of Augusta, Hallowell, Gardiner, Waterville and other municipalities having a population in excess of 55,000. The company is steadily developing its earning power and is broadening its field of service through new lines and extensions. It operates five water-power developments, supplemented by steam reserve, all interconnected and operated in unison. The hydroelectric plants have a rated capacity of 6800 hp and the steam station a capacity of 2500 hp. The company was incorporated in 1905 and has acquired the entire property and franchises of the Messalouskee Electric Company, the Fort Halifax Power Company, the Sebasticook Power Company and the Sebasticook Water Power Company. It also owns all the stock of the Kennebec Light & Heat Company, the Bingham Electric Company, the Dexter Electric Company and practically all the stock of the Solon Electric Company. The net earnings of the company for the year ended Aug. 30, 1910, were $128,352 and the surplus available for dividends $78,010.

Consolidated Gas Company.—The Consolidated Gas Company of New York has declared a quarterly dividend of 1½ per cent, which places the stock upon a 6 per cent basis. The company formerly paid this rate of dividend, but after the decision declaring legal the 80-cent gas rate, only 4 per cent was paid. The earnings of the company, however, fully justify the higher dividend upon the stock. The New York Edison Company, which is entirely owned by the Consolidated Gas Company, earned in 1909 more than 10 per cent on its outstanding stock. There is no reason to believe that the Consolidated Gas Company will, in the near future, go below the 6 per cent basis.

Aurora, Elgin & Chicago Railroad.—At the annual meeting of the Aurora, Elgin & Chicago Railroad Company, which operates the interurban electric railway between Chicago, Aurora and Elgin, the purchase of the Chicago, Wheaton & Western road, a feeder line, was approved. It was shown that the gross earnings for the year ended June 30, 1910, were $1,536,898. Operating expenses were $902,777 and the net earnings were $634,121. The latter figure may be compared with $615,452 for the year before. The net income was $331,837, and the amount paid in dividends was $293,213. The surplus on June 30, 1910, was $316,670.

Receivers for Interstate Telephone & Telegraph Company.—Fred A. Dolph, of Aurora, Ill., and William C. Niblack, vice-president of the Chicago Title & Trust Company, have been appointed receivers for the Interstate Telephone & Telegraph Company, of Aurora, Ill., operating a telephone service in about twenty-five cities and villages of Northern and Central Illinois, including Peoria, Springfield, Joliet, Aurora and Elgin. The company has failed to pay its bond interest, and charges of mismanagement against a former administration are made by the owners of the company's stock and bonds who applied for the receivership.

Nashville Railway & Light Company.—The earnings of the Nashville Railway & Light Company show liberal increases over the previous year. The September gross scored an improvement over September, 1909, of nearly 5 per cent. The estimated earnings for the year are gross $1,825,000, which is an increase of more than $100,000 over the previous year. If these estimates are carried out, the balance available for dividends after paying interest charges will be about $360,000, which is approximately 4½ per cent on the common stock after paying the preferred dividends.

Bodwell Water Power Company.—The United States Circuit Court, District of Maine, has appointed E. H. Mather special master to conduct the sale of the Bodwell Water Power Company property in Milford and Old Town, Me., under a foreclosure decree dated Oct. 8, 1910, in the case of the Central Trust Company of New York, trustee, to foreclose a mortgage of $1,000,000. Messrs. E. H. Mather and J. W. Harmon have been receivers of the property.

American Light, Heat & Power Company.—Articles of incorporation have been filed in Dover, Del., for the American Light, Heat & Power Company, with a capitalization of $15,000,000. The purposes of the company, as stated in the charter, are "to generate, accumulate and furnish light and heat." No information as to the incorporators has been given out.

Iowa Traction Company.—The Iowa Traction Company has been incorporated under the laws of New Jersey with a capital of $2,000,000, to build a line from Oskaloosa, Ia., to Tama, a distance of sixty-five miles.

DIVIDENDS.

American District Telegraph Company of New York, semi-annual, 1 per cent, payable Nov. 5.

American Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

American Telegraph & Cable Company, quarterly, 1½ per cent, payable Dec. 1.

Consolidated Gas Company, quarterly, 1½ per cent, payable Dec. 15.

Massachusetts Gas Companies, semi-annual, preferred, 2 per cent, payable Nov. 15.

McCrum-Howell Company, common, quarterly, ¾ per cent, payable Jan. 1, special 50 per cent, payable Nov. 1.

New Orleans Railway & Lighting Company, preferred, quarterly, 2½ per cent, payable Jan. 16.

Portland Railway, Light & Power Company, quarterly, 1 per cent, payable Nov. 15.

Standard Motor Construction Company, semi-annual, 2 per cent, payable Nov. 15.

United States Steel Corporation, quarterly, preferred, 1¾ per cent, payable Nov. 29; common, 1¼ per cent, payable Dec. 30.

Washington (D. C.) Gas Light Company, quarterly, $1.20 per share, payable Nov. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Cumberland Telephone Company:					
September, 1910	$575,272	$319,772	$255,500	$49,038	$206,462
September, 1909	533,329	299,491	233,838	43,590	190,348
Detroit United Railroad Company:					
September, 1910	846,297	540,051	306,246	178,802	138,588
September, 1909	751,818	477,851	273,967	158,124	127,606
Interborough Rapid Transit Company:					
September, 1910	2,263,580	932,066	1,331,514	.....	57,091
September, 1909	2,286,235	851,352	1,434,883	.....	195,823
Lehigh Valley Transit Company:					
September, 1910	112,540	49,401	63,139	25,433	37,706
September, 1909	100,340	43,521	56,819	26,650	30,169
Manufacturers' Heat & Light Company of Pittsburgh:					
Nine months ended Sept. 30, 1910	4,097,807	2,054,262	2,043,544	456,548	1,586,997
Nine months ended Sept. 30, 1909	3,864,290	1,523,179	2,341,111	783,654	1,557,456
Northern Ohio Traction Company:					
September, 1910	224,901	117,857	107,044	43,391	63,653
September, 1909	202,156	102,990	99,166	42,928	56,238
Portland (Maine) Electric Company:					
September, 1910	35,125	16,287	18,838	9,933	8,905
September, 1909	28,356	11,562	16,804	9,194	7,610
Rio de Janeiro Tramway, Light & Power Company:					
September, 1910	982,762	474,614	508,148	.....	.....
September, 1909	642,731	366,175	276,556	.....	.....
Sao Paulo Tramway, Light & Power Company:					
September, 1910	260,829	92,037	168,792	.....	.....
September, 1909	200,496	79,548	120,948	.....	.....
St. Joseph Railway, Light, Heat & Power Company:					
September, 1910	92,034	46,332	45,702	23,158	22,544
September, 1909	88,285	40,809	47,476	22,048	25,428

General News

Construction News.

ELBA, ALA.—The Pea River Power Company is contemplating the construction of a dam across the Pea River, for which investigations are now being made by Professor Kay of the University of Alabama. If the construction of a dam is not considered feasible a boiler and engine will be purchased immediately for the local plant.

SCOTTSBORO, ALA.—It is reported that the Section Telephone system, formerly owned by a stock company, has been purchased by J. S. Ryan. The new owner, it is said, proposes to extend the lines and install new equipment.

WARREN, ARK.—The capital stock of the Warren Light & Water Company has been increased from $20,000 to $50,000.

FRESNO, CAL.—Preparations are being made for the construction of an electric railway from Fresno to Clovis, a distance of fifty miles, work on which will begin as soon as the right of way is secured. S. N. Griffith is promoter.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company is erecting two new telephone buildings; the one in Glendale will be completed in November and the one in Wilshire will be opened in December. Both will be equipped with new and up-to-date apparatus. The building in Wilshire will be of reinforced concrete and will cost about $225,000.

MANTON, CAL.—The work under way at Eagle Camp, on the North Butte River, nine miles below Manton, by the Northern California Power Company is nearly completed. The work includes a dam 65 ft. wide and 10 ft. high, and a total of 1325 ft. of tunneling has been drilled within a mile. The water will be carried to the Inskip ditch by 3674 ft. of flumes, which will be utilized to generate electricity at the Inskip power house, two and one-half miles below. J. C. Cochrane is engineer.

OROVILLE, CAL.—It is reported that parties interested in the Oro Water, Light & Power Company are making investigations in the Humbug Valley with a view of developing the water-power of Yellow Creek. It is proposed to erect a large plant at the mouth of the creek at the Feather River, about eight miles from Longville. The company has purchased nearly 2500 acres in the valley for reservoir purposes. J. W. Goodwin is president of the company.

PLACERVILLE, CAL.—Work has commenced on the construction of the dam of the Rubicon Power Company, which will be located at Upper Hill Hole, on the Rubicon River, where a small dam will be built that will back up the water three miles. The water will be conveyed down the canyon in ditches, nine miles, into another reservoir at Hale's Crossing, and from there to Pilot Creek. The power plant will be located at Ralston's divide, where the water will have a fall of 2000 ft. C. H. Wilbur is superintendent.

REDDING, CAL.—A tunnel, six and one-half miles long, for carrying water from Pit River to Montgomery Creek is being constructed by the Mount Shasta Power Company, under the direction of Harry Hatfield, of San Francisco. The water will have a fall of 800 ft. from the entrance of the tunnel to the outlet.

SAN FRANCISCO, CAL.—Negotiations are reported to be under way whereby the Pacific Gas & Electric Company, of San Francisco, Cal., will lease the property of the Western Power Company for a period of forty six years from Jan. 1, 1911. Under the terms of the contract the Pacific Gas & Electric Company agrees to guarantee the dividends on the common stock of the Western Power Company as follows: Beginning at the rate of 2½ per cent in 1912 and 1913, and increasing one-half of 1 per cent yearly thereafter until the rate reaches 7 per cent per year, at which figure it is to remain until the expiration of the lease. In addition to guaranteeing the dividends on the common stock the Pacific company, it is said, agrees to maintain the property of the Western Power Company in good order, appropriating a certain amount of the net earnings each year for that purpose. For some years the Pacific company has had a contract with the power company, under which the latter supplied it with 25,000 hp a year. The Western Power Company owns lands and water rights in Northern California, its main power plant being located about 160 miles northeast of San Francisco; it also owns the California Electric Generating Company, which has a large steam turbine plant on the water front in Oakland.

STOCKTON, CAL.—It is reported that the Pacific Gas & Electric Company has secured the control of the Stockton Gas & Electric Company and the American River Electric Company.

WASHINGTON, D. C.—The Commissioners of the District of Columbia have authorized the installation of seventy-five electric incandescent lamps of 40 cp to replace the gas lamps in Brookland. The lamps will be suspended from the trolley poles of the new section of the street railway running through Brookland. The new lamps include a lighting system for the ornamental posts on the Monroe Street bridge. The lamps will cost $20 each per year.

FORT MEADE, FLA.—Preparations are being made by S. T. Rivers for the construction of an electric light plant in Fort Meade, Fla., to cost about $4,000, bids for construction of which have been received.

MONTICELLO, GA.—Contracts have been awarded for machinery for the Jasper Cotton Mills. The plant will have a capacity of 10,000 spindles and will be equipped for electrical operation. L. O. Benton is interested in the project.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company has submitted a proposition to the City Council offering to increase the street-lighting system at a lower rate than charged for the present service, provided a five-year contract be given the company. At the present time the city pays about $97 per month for the lighting service; under the proposal submitted the company offers to double the service for $140 per month. The Council is willing to make a contract for one year, but the company is not willing to accept a contract for less than five years.

WALLACE, IDAHO.—The directors of the North Idaho Telephone Company are reported to have authorized an issue of bonds to the amount of $50,000, the proceeds to be used for making extensions to the system.

BENTON, ILL.—Arrangements are being made by the Hamilton Utility Company for the erection of a new electric plant on the property recently acquired in the Martin & Copple addition. The equipment of the new plant will include a 350-hp Corliss engine and the output will be double that of the old plant. The machinery in the old power house will be removed to the new power station and will be used for day service and emergencies. The company also proposes to install a water-works system; the pumping station will be located on a 77-acre tract, where a dam will be built and a settling basin made.

CHICAGO, ILL.—The Interstate Telephone & Telegraph Company, operating in twenty-five cities and towns in northern and central Illinois, has been placed in the hands of receivers. It is asserted that the liabilities of the company exceed its assets by $1,000,000. Fred A. Dolph, of Aurora, Ill., and William C. Niblack, of Chicago, Ill., were appointed receivers.

CHICAGO, ILL.—The City Council has authorized the city controller to advertise for bids for the sale and removal of the old arc lighting equipment in the municipal electric plants, consisting of boilers, condensers, steam engines, piping and a number of arc generators. As the city now secures electricity from the power plant of the Sanitary District of Chicago it has decided to dispose of the above equipment.

CLINTON, ILL.—Extensions are being made to the plant of the Clinton Gas & Electric Company, including an addition to the power house, which will be equipped with two 400-hp Murray-Corliss engines, direct connected to two 200-kw, three-phase, 60-cycle, 1100-volt generators and new switchboard. A new stack is also being erected.

KANKAKEE, ILL.—The directors of the Kanhakee & Urbana Traction Company have called a special meeting of the stockholders, to be held Nov. 22, to vote on the proposition to increase the capital stock of the company from $500,000 to $2,500,000. Preliminary arrangements have been made for the construction of an electric railway to connect Kankakee and Charleston, 125 miles in length. W. K. Brook, is president.

MARION, ILL.—The Marion Electric Light & Street Railway Company has changed its name to Marion Light, Power & Water Company and increased its capital stock from $20,000 to $100,000.

NEW HOLLAND, ILL.—The capital stock of the New Holland Telephone Company has been increased from $2,500 to $10,000.

SAVANNA, ILL.—Plans are being considered for the construction of an electric railway connecting Sterling, Coleta, Milledgeville and Lanark, and from Lanark east and west to Freeport and Savanna. W. Osborne, of Chicago, Ill., is promoter.

CHESTERTON, IND.—The new pole line of the Northern Indiana Gas & Electric Company from Michigan City to Chesterton has been completed. It is understood that the company will soon be ready to supply electricity for lamps and motors in Chesterton and Porter. The service will be supplied from the power plant at Michigan City. The company is erecting a new power plant at East Chicago, Ill., and will erect a transmission line from that city via Chesterton to Michigan City and connect the two power plants. It is expected that the company will supply the entire territory between Hammond and Michigan City by next spring.

CLINTON, IND.—It is reported that the twin collieries of the Bunsen Coal Company, a subsidiary of the United States Steel Corporation, located south of Clinton, Ind., are being equipped with electrical apparatus and a large power plant being installed.

ELKHART, IND.—Plans are being considered by the Elkhart Industrial Association for installing an ornamental street lighting system on Main Street from Jackson Street to the Lake Shore. Under the present plan the Industrial Association proposes to install the posts and lamps and the city to maintain the lamps.

FORT WAYNE, IND.—Preparations are being made by the Home Telephone & Telegraph Company for enlarging its exchange. A contract has been awarded to the Stromberg-Carlson Telephone Company, of Rochester, N. Y., for an addition to the main switchboard to provide for 300 lines.

INDIANAPOLIS, IND.—The capital stock of the Indiana Power Company has been increased from $25,000 to $50,000.

MARION, IND.—The Indiana Supreme Court has handed down a

decision which declares that the Marion Light & Heat Company, which acquired its franchise rights from a preceding company, must carry out a provision providing for the furnishing of heat and light, free of cost, to the library building, notwithstanding the library building was not erected until long after the franchise was granted.

MICHIGAN CITY, IND.—The Chicago, Lake Shore & South Bend Railway Company is building a new substation at Charleston and a new three-phase, 60-cycle transmission line from its power plant in Michigan City to Hammond, Ind. The company has placed orders with the General Electric Company, of Schenectady, N. Y., for two 1000-kw motor generator sets and frequency changers, with necessary transformers, and is preparing to supply electricity for motors on a large scale. C. N. Wilcoxon is general manager.

NOBLESVILLE, IND.—Notice has been given that the plant and holdings of the White River Light & Power Company, of Noblesville, Ind., will be sold at auction on Nov. 19, at the court house, at Noblesville, Ind. The property includes the dam site, together with concrete dam in process of construction, two concrete cottages and certain tracts of land, which constitute the reservoir; also transmission line connecting the power house of the company, about two and one-half miles distant, and the distributing system in Noblesville, and all tools and equipment in connection with the plant; also all contracts, rights and franchises granted the company by the Council of Noblesville. Ralph H. Beaton is receiver of the company.

SOUTH BEND, IND.—The Southern Michigan Railway Company is contemplating the construction of an extension to Buchanan, Mich., a distance of four miles.

ADAIR, IA.—The question of granting an electric light franchise in Adair is under consideration by the Town Council. J. J. Hayden is town clerk.

ALLERTOWN, IA.—The contract for the construction of a new power house for the municipal electric light plant was awarded to A. Mardis, of Corydon. The plant was destroyed by fire on Oct. 6.

CEDAR FALLS, IA.—The Waterloo, Cedar Falls & Northern Railway Company is contemplating extending its railway to Dike, a distance of about ten miles.

CLINTON, IA.—The Commercial Club is reported to have called for bids for the installation of curb lamp posts on Second Street.

ELLIOTT, IA.—R. O. Prather, of Griswold, Ia., is reported to have applied for a franchise to construct and operate an electric light plant in Elliott.

NEWTON, IA.—The Board of County Commissioners has awarded the contract for the installation of an electric light plant at the county farm to the Monarch Machine Company, of Des Moines, Ia., for $1,150.

STANTON, IA.—The installation of an electric light plant in Stanton is reported to be under consideration.

CHASE, KAN.—The Chase Hardware & Implement Company is reported to be contemplating the installation of a private lighting plant.

STAFFORD, KAN.—At an election to be held Nov. 19 the proposition to issue $25,000 in bonds for the installation of a municipal electric light plant will be submitted to a vote.

GRAPEVINE, KY.—The Perry Telephone Company is contemplating erecting a telephone line from Grapevine to Langnaugh, via Chestnut Gap.

WHITESBURG, KY.—Plans are being considered by the Whitesburg Telephone Company to erect a telephone line from Mandrake to Dry Forks and Line Fork, where it will make connection with the Line Fork Telephone Company's system. Connection will also be made with the lines of the Big Leatherwood Telephone Company.

BALTIMORE, MD.—Plans are being considered for the erection of a large building to be equipped for supplying power either by gas or electricity, to be rented to small manufacturers. The directors of the Consolidated Gas, Electric Light & Power Company have offered to subscribe to half of the stock. The cost of the building is estimated at about $200,000. J. E. Aldred, vice-president of the Consolidated Gas, Electric Light & Power Company, is a member of the committee appointed to promote the enterprise.

HONOR, MICH.—C. G. Hart, of Honor, Mich., is reported to be contemplating the construction of a hydroelectric plant in the near future.

OLIVET, MICH.—A company has been organized in Olivet for the purpose of furnishing electricity in the village and to the college, for which a franchise has been granted by the Village Council, subject to approval of the voters at an election to be held within sixty days. If granted a franchise the company agrees to have the plant in operation within ninety days. E. M. Arnos, treasurer of the college, is interested in the project.

SAGINAW, MICH.—F. W. Carlisle Company, of Saginaw, Mich., have secured the contract for the construction of the leather factory for Spence Brothers in this city. The plant will be equipped with new machinery, including electric motor drive.

BRAINERD, MINN.—A contract has been awarded to the Toltz Engineering Company, of St. Paul, Minn., to supply electricity for a term of ten years in Brainerd. It is understood that machinery will soon be ordered for the proposed plant and it is expected to have the plant in operation by Dec. 1.

PINE RIVER, MINN.—The Village Council has granted a franchise to H. A. and T. L. Arvig to construct and operate an electric light plant in Pine River. A reinforced concrete dam capable of developing 300 hp is now being built by Webber & Hill.

PROCTOR, MINN.—The Commercial Club is reported to be considering the question of providing a lighting system for the town.

CEDARS, MISS.—W. C. Wing, of the Kimberly-Wing Company, is reported to be in the market for equipment for an electric light plant, including an engine, generator, switchboard, etc. The headquarters of the company are located at Neenah, Wis., the Cedars plant being operated as a branch.

MERIDIAN, MISS.—The Meridian Light & Railway Company, is contemplating double tracking its street railway on Eighth Street, in Meridian, and also the construction of an extension to Highland Park.

KANSAS CITY, MO.—The Board of Public Works has approved the plans of the Kansas City Electric Light Company for the installation of underground conduits for carrying its wires in the restricted district in this city. Work will commence on the Southwest Boulevard.

KING CITY, MO.—Preparations are being made by the King City Electric Light & Power Company for the installation of an electric light plant. Fred A. Thompson is manager.

SPRINGFIELD, MO.—The farmers residing south of the city on the James River Club House road propose to organize a company for the purpose of erecting a rural telephone line from Springfield to the James River Club House. J. T. Carter, G. W. Campbell and others are interested in the project.

AVON, MONT.—The Avon Local Home Telephone Company, recently organized with a capital stock of $10,000, is planning to install a new telephone system in Avon, work on which will begin at once.

CHINOOK, MONT.—A committee consisting of A. S. Lohman, Thomas O'Hanlon and W. H. Duke has been appointed to look into the question of installing an electric light plant in Chinook, Mont.

LIBBY, MONT.—The City Council has granted a franchise to E. K. Barnum and P. D. Pratt, of Libby, Mont., to construct and operate an electric light plant, water-works and telephones in Libby. The holders of the franchise propose to install water and electric plants and a telephone system, at a cost of about $100,000.

CARSON CITY, NEV.—The Western Smelters Corporation is reported to have taken over the Brunswick mill site and power site with water rights. It is understood that a large reservoir and power plant will be erected to supply power to the new smelter.

CONCORD, N. H.—Plans are being considered by the Central New Hampshire Power Company, recently incorporated with a capital stock of $2,000,000, for the construction of a large power plant, to be located on the Blackwater River, at Sweatt's mills, in Webster. The main dam will be located at Sweatt's mills and the second dam in Salisbury, above Shaw's mill. The directors of the company are: Frederick L. Houghton, Dennison Cowles, of Brattleboro, Vt., and Nathaniel E. Martin, of Concord, N. H.

HAMPTON, N. H.—The Exeter, Hampton & Amesbury Street Railway Company will soon purchase an electrically driven, centrifugal type fire pump, having a rating of 1000 gal. per minute.

ORANGE, N. J.—The City Council has notified the Public Service Corporation of New Jersey that its service will not be required for longer than ninety days from Oct. 17, 1910, as provided in the agreement between the city and the corporation. It is expected to have the municipal electric plant finished in about two months, which will give sufficient time to try out the plant.

SOUTH RIVER, N. J.—Proposals will be received until Nov. 28 by Charles Anderson, Borough Clerk, for construction of electric light, power and pumping plant and transmission line as follows: Section 1—Furnishing and installing three 125-hp boilers and piping in and about power house, or alternately furnishing and installing two 200-hp gas producers. Section 2—Furnishing and installing two 190-hp steam engines, or alternately two 190-hp gas engines, together with the piping in and about the gas engine plant. Section 3—Furnishing and installing two 800,000-gal, steam pumps, or alternately two 800,000-gal. motor-driven pumps, including all piping, valves and fittings to well. Section 4—Furnishing and installing two 125-kw electric generators and accessories. Section 5—Constructing radial brick chimney, 100 ft. x 5 ft., or alternately a steel stack, 25 ft. x 4 ft., and induced draft apparatus. Section 6—Constructing a covered suction well, complete except piping, diameter 32 ft., depth 33 ft., or alternating diameter 25 ft. and depth 33 ft. Section 7—Furnishing and erecting standpipe 20 ft. x 100 ft. with ladders, automatic altitude valve and connection to main. Section 8—Constructing concrete foundation for standpipe. Section 9—Furnishing material and erecting the building for the power plant, together with all wall and machinery foundations, sewers and conduits. Section 10—Building electrical transmission line from the power house into the borough, a distance of about 9000 ft. Plans and specifications and form of contract may be seen at Borough Hall, South River, N. J., or at the offices of W. W. Young, consulting engineer, 220 Broadway, New York, N. Y.; 46 Park Street, Bordentown, N. J., and Drexel Building, Philadelphia, Pa. Joseph Mark is Mayor.

WESTFIELD, N. J.—The Town Council has entered into a contract with the Public Service Corporation of New Jersey to light the streets of the town for a period of three years. Under the terms of the contract the company is to furnish tungsten lamps at the rate of $18 each per year.

CLAYTON, N. M.—The City Board has taken over the electric and water plants of the Clayton Electric Light & Water Supply Company. It is proposed practically to rebuild both plants during the coming year. A

proposition to issue $50,000 in bonds to pay for proposed improvement, will be submitted to the voters as soon as an election can be called.

DEMING, N. M.—The Deming Electric Company, which has extended its transmission lines from its power plant in Deming to many parts of the Nimbres Valley to supply electricity to operate irrigating pumps and other purposes, supplying motors from 5 to 40 hp, is adding to its transmission system and expects to double its present mileage of lines in the valley by the time the farmers are ready to begin spring work.

BUFFALO, N. Y.—It is reported that plans are being prepared by the Augustine Automatic Rotary Engine Company for extensive additions to its plant at Elmwood Avenue and the Erie Railroad, which will involve an expenditure of about $100,000. Two buildings will be erected at once, an addition to one of the factory buildings, 35 ft. x 100 ft., and a power house, 50 x 50 ft. Two other buildings will be erected in the near future.

CLYDE, N. Y.—The Clyde electric light and gas plants, which have been idle for eight or ten years, are being rebuilt. It is understood that new machinery will be installed in the spring to supply this village and vicinity with electricity and gas.

JAMESTOWN, N. Y.—The construction of an electric railway between Jamestown and Dunkirk, on Lake Erie, via Gerry, Stockton, Centralia, Cassadaga, Lily Dale and Laona, is under consideration and preliminary steps have been taken for securing rights of way. V. E. Peckham, Arsell C. Price and Robert M. Garfield are interested in the project.

MONTICELLO, N. Y.—The Monticello Electric Light & Development Company is contemplating the construction of an electric power plant, to cost about $20,000. Blake A. Mapledoram is chief engineer and manager.

MORRISTOWN, N. Y.—The Public Service Commission, Second District, has granted M. W. Gregory, of Morristown, permission to construct and operate an electric light plant in this village.

NEW YORK, N. Y.—Sealed bids will be received by William H. Edwards, Commissioner of Street Cleaning, at the office of the Department of Street Cleaning, Room 1403, 13 to 21 Park Row, New York, N. Y., until Nov. 9 for furnishing and installing a complete electric lighting system in the new eastern portion of stable "A" of the Department of Street Cleaning, Seventeenth Street and Avenue C. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Sealed bids will be received by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, at the office of the Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, New York, N. Y., until Nov. 16 as follows: Section 1—For furnishing and installing electric control cables in underground ducts from the South Street high-pressure pumping station to the gate valve vaults in New Chambers Street, east of New Bowery, and in East Houston Street, each of the Bowery. Section 2—For furnishing and installing motor-operated gate valves, subsidiary ducts, etc., with all appurtnances complete, in the high-pressure fire-service mains in New Chambers Street, east of New Bowery, and in East Houston Street, east of the Bowery. Specifications and blank form of contract can be obtained at the above office.

NIAGARA FALLS, N. Y.—Arrangements have been made between the City Council and the merchants whereby the special illumination system on Queen Street, Erie Avenue and Bridge Street will be in operation until the end of the year.

PALATINE BRIDGE, N. Y.—The Board of County Supervisors of Montgomery County has authorized the installation of an improved lighting plant, either gas or electricity, for lighting the county buildings at Palatine Bridge.

HIGH POINT, N. C.—Arrangements are being made by the High Point Hosery Mills for the installation of 125 additional knitting machines, which will be installed in the new addition. The cost of the machinery is estimated at about $25,000. The mills of the company are operated by electricity.

SMITHFIELD, N. C.—Arrangements are being made for the construction of a municipal electric light plant, bids for construction of which have been called for. James A. Wellons is Mayor.

TAYLOR, N. D.—Arrangements are being made by the People's Telephone Company for the construction of new rural lines. Henry Mason is president.

BEREA, OHIO.—The Youngstown Armature & Construction Company, of Youngstown, Ohio, has been awarded the contract for the new switchboard for the municipal electric light plant in Berea, for $1,471.

CLEVELAND, OHIO.—It is reported that plans have been prepared for extensions to the water works system in Cleveland and bids will soon be advertised for equipment for same, which will include two 25,000,000-gal. pumping engines for the Kirkland pumping station, to replace the two 15,000,000 gal. low-duty pumping engines now in use. The plans call for the erection of a high-pressure pumping station with four centrifugal units with a capacity of 10,000 gal. per minute and a 270 lb. pressure. It has not yet been decided whether to install gas engines or electric motors to operate the pumps, for which 2000 hp will be required.

COLUMBUS, OHIO.—It is reported that the Fifth Avenue Railway & Light Company is planning to erect a power plant on West Fifth Avenue, near the Hocking Valley Railroad tracks. The company proposes to operate a crosstown line in East Fifth Avenue and West Fifth Avenue.

COLUMBUS, OHIO.—Contracts have been awarded by the City of Columbus for equipment for the Scioto River pumping station as follows: For two motor-driven centrifugal pumps, one of 20,000,000 gal. capacity and the other of 5,000,000 gal. capacity, to the Platt Iron Works, of Dayton, Ohio, and to the Burke Manufacturing Company, of Erie, Pa., for two 250-hp synchronous motors to drive the pumps.

IVORYDALE, OHIO.—The Procter & Gamble Company, it is reported, is increasing the output of its power plant and enlarging its machine shop at Ivorydale.

JACKSON, OHIO.—All bids received Oct. 20 for machinery, etc., in connection with improvements to the municipal electric light plant have been rejected by the Board of Public Affairs. New bids will be called for later. W. A. Dallas is clerk of board.

LANCASTER, OHIO.—The contract for boilers for the light and power plant for the Boys' Industrial School, at Lancaster, Ohio, has been awarded to the McNaul Boiler Manufacturing Company, of Toledo, Ohio, at $5,955. F. C. Gurlach is superintendent.

MT. VERNON, OHIO.—The Mt. Vernon Electric Company, recently incorporated with a capital stock of $300,000 by N. C. L. Kachelmacher and others, will take over the local street railway and lighting properties which were purchased at receiver's sale by Mr. Kachelmacher and associates some time ago. Mr. Kachelmacher will be the president and treasurer of the new company, while Charles V. Critchfield will be the secretary. The new power plant now under way will be completed and the street railway lines will be extended to the new state sanitarium just completed near the town.

NEWARK, OHIO.—The construction of an electric railway to connect Newark, Coshocton and Uhrichsville is reported to be under consideration. E. A. Nesbit, of Pittsburgh, Pa., and A. E. Townsend, of Doylestown, are reported to be interested in the project.

OSTRANDER, OHIO.—The directors of the Ostrander Telephone Company have called a meeting of the stockholders to vote on the proposition to increase the capital stock of the company from $10,000 to $40,000.

TOLEDO, OHIO.—Among the proposed amendments to the city charter which are to be voted upon at the coming election is one which will provide that the city may generate and sell electricity for commercial and private use, as well as street and public lighting, the contracts to be limited to periods of three years. It also provides that the city may erect a lighting system and lease it to another person or corporation for operation, under terms to be fixed by the City Council.

HOLLIS, OKLA.—The City Council has granted a franchise for the installation of an electric light plant in Hollis. From twenty to thirty street lamps will be installed.

NOWATA, OKLA.—The Coffeyville-Nowata Railway & Power Company is reported to have awarded the contract for the construction of its proposed railway to connect Coffeyville, Kan., and Nowata, Okla, a distance of twenty-three miles, to Robert L. Plunkett, of Coffeyville, Kan. W. V. Thraves, of Nowata, Okla., is general manager.

FOREST GROVE, ORE.—The City Council has granted A. Welch, of Portland, Ore., a franchise to erect transmission lines on certain streets in Forest Grove for the distribution of electricity for lamps and motors.

FOREST GROVE, ORE.—Negotiations have been completed whereby the Independent Electric Company, recently incorporated in Multnomah County with a capital stock of $100,000, has purchased the plants and holdings of the Haines Light & Power Company, of Forest Grove, and of the Hillsboro Water, Light & Power Company, which controls a hydro-electric power plant located about sixteen miles from Forest Grove. The new company contemplates extensive improvements and extensions to the plants and also extension of the transmission lines to Beaverton, Arenco, Cornelius and Dilley. R. H. Boykin, 502 Fenton Building, Salem, Ore., is president of the company. Headquarters of the company will be located in Portland, Ore.

FORT KLAMATH, ORE.—We are informed that there is a good opening for an electric light plant in Fort Klamath, Ore. For further information address Joseph Hessig, president of the Klamath Telephone & Telegraph Company, Fort Klamath, Ore.

HERMISTON, ORE.—B. A. Chrisholm, of Meadows, Idaho, is reported to be contemplating the installation of an electric light plant in Hermiston.

ALLENTOWN, PA.—The Lehigh Valley Transit Company is asking for bids for one 5000-kw turbine with boilers, condensers and auxiliaries. The bids are requested through Ford, Bacon & Davis, consulting engineers, 115 Broadway, New York, N. Y.

LOCK HAVEN, PA.—The Island Dunnstown Telephone Company, recently organized, proposes to erect a telephone line in the vicinity of Dunnstown to connect with the Bell Telephone Company. Jacob Myers is president and Charles Rote is manager, both of Dunnstown, Pa.

MARCUS, HOOK, PA.—The Borough Council is considering a proposition submitted by A. R. Granger, vice-president and manager of the Beacon Light Company, of Chester, Pa., to supply electricity for lamps and motors in Marcus Hook.

OXFORD, PA.—M. C. Martin, of New York, N. Y., is reported to be interested in a project to build an electric railway to connect Newark, N. J., and Wilmington, Del., where it will make connections with the railway extending from Philadelphia to Kennett.

PROVIDENCE, R. I.—Plans are being prepared by the Rhode Island Company for doubling the output of its Manchester Street power house, at a cost of about $300,000. It is expected that contracts for machinery will be awarded within thirty days. The new equipment will include a 13,500-kw, 11,000-volt, three-phase, 25-cycle turbo-generator set, with condenser, switchboard panels, three 2000-kw rotary converters with foundations, wiring, exciters, etc., coal-hoisting apparatus, relocation of two 2500-

kw, horizontal turbo-generator with a new condenser, piping, etc. It is expected to have the work completed by next June or July. A. E. Potter is general manager.

DOYLE STATION, TENN.—The Doyle Springs Telephone & Telegraph Company, recently incorporated, is planning to erect a telephone line to connect Sparta, McMinnville and Spencer, Tenn, sixty miles in length. R. E. Lee Smith is manager.

HUMBOLDT, TENN.—Plans are being considered by R. Lee Reaves, I. H. Duggan and T. E. Babbitts for the construction of a water power plant. They propose to construct two boats to form a race and be anchored in stream. The plant can easily be towed to a new location when necessary. Estimates are now being made on machinery for same. R. Lee Reaves is engineer in charge.

OLIVE SPRINGS, TENN.—The Olive Springs Telephone Company is contemplating the erection of several miles of telephone line connecting Harriman and Clinton, Tenn. J. C. Edwards is manager.

CLARKSVILLE, TEX.—Arrangements are being made to rebuild the electric plant of the Clarksville Light Company, which was recently destroyed by fire. The new plant will have about double the output of the old plant. The company is now being reorganized.

COTULLA, TEX.—It is reported that the City Council is prepared to grant a franchise for the installation of electric light, water and ice plants in Cotulla. For further information address C. F. Burkley, Mayor.

GEORGETOWN, TEX.—At an election held recently the citizens voted in favor of the proposition to issue $45,000 in bonds, the proceeds to be used to purchase water and light plants of the Georgetown Water, Light & Power Company. Extensive improvements and extensions will be made to both systems.

HUBBARD CITY, TEX.—Contracts have been awarded by the Union Central Light & Ice Company, of Hubbard City, Tex., to the Allis-Chalmers Company, of Milwaukee, Wis., and the Skinner Engine Company, of Erie, Pa., for automatic generating machinery, and to the Phoenix Iron Works, of Meadville, Pa., for boilers. W. A. Bass is president and general manager of the Union Central Light & Ice Company.

LIVINGSTON, TEX.—The Livingston Electric Light Company has changed its name to the Livingston Manufacturing Company and has increased its capital stock from $2,000 to $15,000. The company contemplates making improvements to its electric light plant.

NEW BRAUNFELS, TEX.—We are told that the City of New Braunfels is contemplating the construction of a hydroelectric power plant, the power developed will be used primarily for its water-works system and later for an electric system. The proposed work includes the construction of a dam, power house, turbines, pumps, standpipe, pumping station, generators, and several miles of transmission line, as the pumping station will be located some miles from the dam. The city is now ready to have plans and specifications submitted. Adolf Henne is chairman of committee in charge of the proposed plant.

PEARSALL, TEX.—The Pearsall Gin Company is reported to have sold its electric plant to the Pearsall Water, Light & Ice Company. It is understood that the two plants will be consolidated.

PEARSALL, TEX.—It is reported that plans are being prepared by the Southwestern Telephone Company for improvements to its systems in Pearsall and at Cotulla. A switchboard providing for 300 lines has been ordered for the local exchange and the entire system will be overhauled. The erection of several rural lines is under consideration.

SAN ANTONIO, TEX.—The Terrell Hot Wells Company, which is building the new town of San Jose, five miles from this city, is negotiating with the International & Great Northern Railroad Company with a view of equipping that portion of the railroad for electrical operation between San Antonio and San Jose for suburban traffic. Announcement has been made that if this is not done the electric railway system of San Antonio will be extended to San Jose.

TEXARKANA, TEX.—Owing to the refusal of the Southwestern Telephone Company to accept the franchise offered by the City of Texarkana, an effort is being made by the city to purchase the plant of the Texarkana Telephone Company in this place, now in the hands of a receiver. A. C. Stuart is receiver.

TEXAS CITY, TEX.—The stockholders of the Texas City Transportation Company have authorized an expenditure of $1,500,000 for additional improvements to the deep-water port which it is creating at Texas City. Of this appropriation $1,000,000 will be used to extend the company's terminal system, which will include the construction of ten more miles of track, giving the system a total of forty miles; the installation of additional electric cranes and the erection of another steel and concrete warehouse. An appropriation of $500,000 was made for the installation of an electric light system, water works plant and sewer system. The present electric power plant will be enlarged and will have sufficient output to supply electricity for industrial plants in Texas City and adjacent territory. A. B. Wolvin, of Duluth, Minn., is president of the company.

GRAHAM, VA.—The Town Council is reported to have accepted the proposal of the Graham Railway & Electric Company for a franchise to construct and operate an electric light plant and electric railway system in Graham.

LEXINGTON, VA.—The report of the special committee appointed by the Town Council to investigate the electrical service furnished by the Lexington Light & Power Company recommends the installation of a 200-hp steam plant in addition to the present water-power plant in order to provide adequate service for lighting the streets and residences of the town. The committee advises the improvement to be made within six months. The unsatisfactory service is due to the low water in North River, which furnishes power for the plant.

NORFOLK, VA.—Proposals will be received by the Board of Control until Nov. 19 for furnishing and installing three electrically-driven centrifugal pumps at Colley Avenue sewer pumping station as follows: One 2000-gal. pump, one 3000-gal. pump and one 4000-gal. pump. William Waller is engineer of power station.

BEVERLY, WASH.—It is reported that plans have been completed for the installation of an auxiliary pumping plant at the lower end of the Strahorn power ditch at Priest Rapids.

CENTRALIA, WASH.—The City Council has instructed the city clerk to advertise for bids for a complete generating plant, including two 500-kw steam turbo-generators with boilers and accessories. Plans and specifications can be obtained from C. A. Harmon, city electrician.

ELLENSBURG, WASH.—The City Council has decided to abolish the flat rate system in connection with the municipal electric light plant and install meters. The Council has awarded the Olympic Foundry Company, of Seattle, Wash., a contract for furnishing fourteen lamp standards for cluster lamps, complete with globes, at $46.90 each.

HOQUIAM, WASH.—The City Council has authorized the city clerk to advertise for bids for street lighting on I and Eighth Streets; separate bids will be asked for the rest of the city.

NORTH YAKIMA, WASH.—The controlling interest of the Yakima Valley Telephone Company has been purchased by the Manuel Brothers Company, of North Yakima and Minneapolis, Minn. The new offices of the company are: S. K. Bartholomew, president and superintendent; M. H. Manuel, vice-president, and H. W. Manuel, treasurer.

SEATTLE, WASH.—The contract for installing cluster lamps on Stewart Street, subdivision No. 1, has been awarded to the Agutter-Griswold Company, for $12,972; the contract for subdivision No. 2, on the same street, was awarded to the Standard Engineering Company, at $1,754.

SPOKANE, WASH.—It is reported that the International Electric Company, Ltd., with headquarters in Nelson, B. C., and Portland, Ore., is contemplating the construction of a large hydroelectric plant on the Pend Oreille River, just north of the international boundary.

SPOKANE, WASH.—The report submitted by W. E. Moore, hydraulic engineer, engaged by the City Council to investigate the project to develop the available power at the up-river pumping station, estimates that it will cost about $400,000 and that about 5500 hp can be obtained. As this will not give the city sufficient power it will be necessary to secure other power sites.

SPOKANE, WASH.—The Panhandle Electric Railroad & Power Company has submitted a proposition to the City of Spokane offering to supply the city with electricity for a term of years at a much lower rate than now paid by the city to the Washington Power Company, with the privilege of taking over the plant at the end of the contract. The company offers to enter into a contract with the city to invest approximately $2,000,000 in a power plant on Priest River and supply electricity to the city for a term of five or ten years, and at the end of the contract to turn the plant over to the city at a price to be named in the contract or to be fixed at that time by appraisers. The company has also offered to sell the city its rights on Priest River, allowing the city to build its own plant. The Panhandle Electric Railroad & Electric Company owns two power sites on the Priest River, sixty and seventy-two miles respectively from Spokane, one located six miles north of the Town of Priest River, where it is estimated that about 10,000 hp can be developed, and the other two miles south of Priest Lake, capable of developing about 15,000 hp, the two sites being about twelve miles apart.

WHITE SALMON, WASH.—Owing to the increase in the demand for electrical service, the Husum Power Company, which supplies electricity in White Salmon, Husum and Bingen, has decided to make extensions to its plant, including the erection of a concrete dam, which will be located near the old dam at Husum, six miles north of this place.

BUCKHANNON, W. VA.—The power plant of the Buckhannon Light & Water Company was partially destroyed by fire Oct. 25. The city will be without electrical service until some temporary arrangements can be made at the plant, which will probably be a week or more. The pumping plant of the water-works system was also put out of commission.

PARKERSBURG, W. VA.—Bids will be received by the City Council until Nov. 9 for furnishing electricity for lighting the city after Jan. 1, 1911, each proposal to be on a basis of at least 250 arc lamps of 2000 cp and not less than 50 alley lamps, to be located as directed by the city authorities. Proposals may be based upon one-year, five-year and ten-year contracts. Frank Good is city auditor.

APPLETON, WIS.—The Wisconsin Telephone Company is contemplating the construction of a new telephone exchange in this city, at a cost of about $300,000.

CRIVITZ, WIS.—The organization of a farmers' telephone company in Ellis Junction is under way. It is proposed to erect a telephone system covering an area of about ten miles. C. A. Cornell, of Crivitz, Wis., is interested in the project.

DARLINGTON, WIS.—The power house of the Darlington Electric Light & Water Power Company is reported to have been destroyed by fire, causing a loss of about $10,000.

EAU CLAIRE, WIS.—It is reported that the Lindermann Box &

Veneer Company, of Eau Claire, Wis., has decided upon the construction of a steel and concrete building, which will be equipped for double the capacity of the one burned last spring. The plant will be equipped for electrical operation.

JANESVILLE, WIS.—The property of the Janesville Street Railway Company was purchased by the bondholders at an auction sale for $125,000. It is understood that the company will reorganize as part of the Rockford Interurban system.

SCHOFIELD, WIS.—Preparations are being made for rebuilding the mill of the Brooks & Ross Lumber Company, which was burned last summer. It is expected that the plant will be equipped for electrical operation.

SHEYBOGAN, WIS.—The Thomas Toy Coaster Company is reported to be contemplating the purchase of an electric generating unit.

SHEBOYGAN, WIS.—It is understood that the S. W. Miller Piano Company will be in the market for a line of motors for its new factory in the near future.

WEYWAUWEGA, WIS.—O. A. Rice is reported to be interested in the organization of a company for the purpose of installing a new telephone system in Weywauwega. Dr. S. M. Keyes and H. Reif are also interested in the project.

WILTON, WIS.—Dr. Carl Vogel is reported to have been granted a franchise to install an electric light plant in Wilton.

SARATOGA, WYO.—The plant and holdings of the Saratoga Light, Heat & Power Company are reported to have been purchased by D. E. Winsor. It is understood that repairs will be made to the system and the service improved.

VANCOUVER, B. C., CAN.—Following the visit of J. R. Freeman, engineer, who was appointed by the Dominion government to make an investigation of the proposed dam to be constructed by the Vancouver Power Company at Coquitland, B. C., it is understood that that company will be allowed to proceed with the construction of the dam provided that certain conditions are complied with, which, it is said, will involve a change in the position of the dam, the present level of the lake to be lowered and the land flooded by the present dam to be stripped of all rubbish and waste material.

DAUPHIN, MAN., CAN.—At an election held recently the by-law appropriating $11,000 for an electric light system was carried.

WINNIPEG, MAN., CAN.—Bids will be received by the Board of Control until Dec. 7 for overhead wire and cables for the electrical distribution system of Winnipeg. Specifications and blank forms of proposal may be obtained from Smith, Kerry & Chase, engineers, Federation Life Building, Toronto, or Winnipeg. M. Peterson is secretary of board.

MATHESON, ONT., CAN.—It is reported that the development of the water-power at McDougall's Chutes to be utilized to generate electricity for lamps and motors in Matheson is under consideration.

ORILLIA, ONT., CAN.—The City Council has decided to make improvements to the municipal electric light plant, to cost about $10,000. A by-law will be submitted to the ratepayers asking for authority to make the expenditure. Further extensions to the plant will be necessary within a year or two, these including the installation of a new unit and water-wheel capacity and involving an expenditure of from $25,000 to $30,000.

OTTAWA, ONT., CAN.—Announcement was made on Oct. 26 that the International Waterways Commission would not render a decision on the proposed Long Sault dam on the St. Lawrence River. The matter will be left to the new commission provided for in the International Waterways Treaty between Canada and the United States, which will be appointed about the end of this year.

PETERBORO, ONT., CAN.—The Canadian Machine Telephone Company is reported to have applied to the City Council for an extension of its franchise in Peterboro for a term of twenty-five years, in return for which the company agrees to make improvements to its system, which will involve an expenditure of $10,000, and to give free connections with all rural telephones within a radius of ten miles.

RENFREW, ONT., CAN.—The power house of the Renfrew Electric Light Company was destroyed by fire on Oct. 20. The machinery was saved, damaged only by water. The Renfrew Power Company will supply electricity for lighting the city until the plant is rebuilt.

TILSONBURG, ONT., CAN.—The by-law to appropriate $25,000 to construct an electric power station for the distribution of electricity supplied by the Hydro-Electric Power Commission in Tilsonburg was carried at an election held recently.

TORONTO, ONT., CAN.—The City Council has rejected the recommendation of the Board of Control that the corporation seek legislation giving authority to the city to purchase the railway system of the Toronto Railway Company.

TORONTO, ONT., CAN.—The Toronto Electric Light Company has submitted a proposition to the City Council offering to sell its entire plant and system to the city, upon a valuation to be determined by arbitration, with a compensation for the franchise of the company, which yet has nine years to run. The company also made an alternate proposal, in case the city did not care to purchase the plant, that it should define the company's rights on the streets of the municipality, under its franchise, to erect transmission lines; also to define its privileges within the newly annexed districts, and, further, what position the city intended to assume with reference to lighting the streets after the present contract with the company expires in Dec. 31, 1910. The City Council has taken the company's proposition under consideration for sale of the plant, and also stated that the company has rights only on the streets which were conferred by the original agreement, and that the Council was prepared to make a temporary arrangement for street lighting, pending the completion of the municipal hydroelectric distribution and lighting system.

MONTREAL, QUE., CAN.—E. A. Wallberg, of Montreal, Que., who holds a water power concession on the Mattagami River, is reported to have secured a franchise to construct and operate an electric railway from Matheson to Porcupine.

MONTREAL, QUE., CAN.—The directors of the Montreal Light, Heat & Power Company have authorized an expenditure of $200,000 for the installation of new power station equipment and lamps to meet the requirements of the new street-lighting contract.

MONTREAL, QUE., CAN.—The directors of the Maritime Railway, Coal & Power Company have decided to equip its mines at Gojjins with electric coal cutters and to install an electric power plant of sufficient output to provide for the present requirements at the mines.

MONTREAL, QUE., CAN.—Contracts have been placed by the Montreal Light, Heat & Power Company with the Canadian General Electric Company for equipment in connection with the new street lighting system, which will involve an expenditure of about $250,000, and call for delivery in a few weeks.

ROULEAU, SASK., CAN.—It is reported that the ratepayers have voted to authorize the City Council to borrow $45,000 for improvements to the water-works system and $15,000 for electric lighting system.

CANELAS, MEX.—Preparations are being made by Roger B. Chase for the installation of a 100-hp hydroelectric power plant at his mines, located near Canelas, to provide electricity to operate the machinery in the miles and reduction mill. The work will include the construction of a storage reservoir and canal.

EL ORO, MEX—Plans are being prepared by the Compania Minera Oro Nolan, of El Oro, for equipping its plant for electrical operation. The present steam compressor will be equipped with a 75-hp motor and several smaller motors will be installed to drive the crushers, ventilators and other machinery. The large pump will be driven by a 100-hp motor. Transformers and lighting equipment will be installed. Electricity for operating the plant will be supplied by the Mexican Light & Power Company.

NECAXA, MEX.—The large dam of the Mexican Light & Power Company, at Necaxa, has been completed. The reservoir has a capacity of 6,000,000,000 and forms one of the five reservoirs for operating the hydroelectric power plants of the company. The transmission lines extend to the City of Mexico, the mining camp of El Oro, Puebla and Pachuca.

YOQUIVO, CHIHUAHUA, MEX.—The Yoquivo Development Company is developing a water-power site with a view of installing a hydroelectric power plant at its mines in Yoquivo. The company has been operating the machinery in its mines and mills with electricity generated by steam. Owing to the plant being inadequate to meet the demands made upon it, it was decided to replace it with a hydroelectric plant.

New Industrial Companies.

THE AURIS COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by Russell F. Birchard, 378 Montgomery Street, James Macbeth, 604 St. Marks Avenue, both of Brooklyn, N. Y., and David D. Mallory, 500 Ray Street, Jamaica, N. Y. The company proposes to manufacture electrical instruments, especially to enable the deaf to hear.

THE AUTO-AD COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in advertising devices and apparatus. The incorporators are: B. Moscovitz, L. N. Halpern and G. Rosenson, all of New York, N. Y.

THE BAYER STEAM SOOT BLOWER COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $4,000 for the purpose of manufacturing boiler cleaners. The incorporators are: Frank X. Bayer, Leo J. Bayer, August V. Bayer and Frank A. Bayer.

THE J. S. BRETZ COMPANY, of New York, N. Y., has been incorporated with a capital stock of $30,000 by J. S. Bretz, A. L. O'Shea, of New York, N. Y., and C. V. Tuthill, of Jersey City, N. J. The company proposes to manufacture ball bearings, magneto carburetors, etc.

THE COMET LAMP COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 by James H. Harris, 1497 Broadway; L. M. Weathers, 237 West 109th Street, and E. B. Hesser, 27 William Street, all of New York, N. Y. The company proposes to manufacture and deal in lighting and heating apparatus.

THE WILLIAM CORLISS ENGINE COMPANY OF NEW JERSEY, of Jersey City, N. J., has been incorporated by W. Corliss, I. G. Ladd, of Providence, R. I.; E. W. Corliss, of New York, N. Y., and J. R. Turner, of Jersey City, N. J. The company is capitalized at $100,000 and proposes to manufacture machinery.

THE DODGE'S INSTITUTE ANNEX OF WIRELESS AND RAILWAY INSTRUCTION, of Valparaiso, Ind., has filed articles of incorporation for the purpose of establishing a school in Valparaiso, Ind., to teach telegraphy, railway accounting and other railway instruction. A wireless sending station will be installed and the students will be fur-

nished with portable receiving sets. The company is capitalized at $10,000 and the incorporators are George M. Dodge, Frank Limbeck, M. L. Dodge and M. Dodge.

THE DRAPER-LATHAM MACHINE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $500,000 to manufacture magnetos and other electrical devices, etc. The incorporators are: George O. Draper, 258 Riverside Drive; Charles J. Dannebaum, Hotel Astor, and Albert C. Day, 59 West Forty-sixth Street, all of New York, N. Y.

THE ELECTRIC STEEL COMPANY, of Hoboken, N. J., has been chartered by G. Vintschger, of Hoboken, N. J.; O. W. A. Hammacher, of Flushing, N. Y.; E. Vintschger, of Montclair, N. J., and C. R. Bryson, of Pittsburgh, Pa. The company is capitalized at $55,000 and proposes to manufacture iron, steel, metal materials, etc.

THE GASOLINE ENGINE EQUIPMENT COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Frederick K. Loid, 105 Lord Avenue, Bayonne, N. J.; Thomas Palmer, 704 West 178th Street; Clayton Von Culin, 705 West 178th Street, New York, N. Y. The company proposes to manufacture and deal in boilers and engines, etc.

THE GETT MANUFACTURING COMPANY, of New York, N. Y., has been incorporated by L. B. Gleason, F. B. von Teuber, of New York, N. Y., and A. C. Schultz, of Albany, N. Y. The company is capitalized at $200,000 to manufacture ball bearings, machinery, engines, motor vehicles, etc.

THE KURR-PORR ELECTRICAL CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $17,000 by F. E. Collier, N. E. Wiggins, E. Gresslee, all of 256 Broadway, New York, N. Y. The company proposes to do a general electrical contracting business, supply dealers, etc.

THE LOW SPEED ENGINE COMPANY, of Camden, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing automobiles, air ships, motorcycles, etc. The incorporators are: J. A. MacPeak, H. L. Reese and J. H. Gaul, of Camden, N. J.

THE NATIONAL SIGNAL POLICE COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing and operating signal systems. The incorporators are: Augustus F. Scheu, John F. Nagel and Solomon S. Scheu, all of Buffalo, N. Y.

THE NEW JERSEY TELEPHONE HERALD COMPANY, of Edgewater, N. J., has been incorporated by G. F. Martin, H. P. Jones and E. J. Forhan, of New York, N. Y. The company is capitalized at $500,000 and proposes to manufacture telephone appliances.

THE PENNSYLVANIA ELECTRIC COMPANY, of Philadelphia, Pa., has been incorporated with a capital stock of $20,000 by Frederick M. Shepard, 7816 Lincoln Drive, Benjamin L. Cates and Leon J. Obermayer, all of Philadelphia, Pa.

THE PENNSYLVANIA STORAGE BATTERY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $400,000. The incorporators are: F. R. Hansell, George H. B. Martin and S. C. Seymour, all of Philadelphia, Pa.

THE PENOBSCOT MOTOR COMPANY, of Bangor, Maine, has been incorporated, with a capital stock of $100,000, for the purpose of manufacturing and dealing in automobiles, motors, engines, motor boats, etc. The officers are Fred D. Oliver, president, and J. S. Howe, jr., treasurer, both of Bangor, Maine.

THE RAPP & WAGMAN MANUFACTURING COMPANY, of Camden, N. J., has been incorporated with a capital stock of $100,000 by W. M. Rapp, I. Wagman, R. F. Rapp and L. W. Meyers. The company proposes to do a general mechanical and electrical engineering business, and also founders and machinists.

THE ROCKWELL FURNACE COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $300,000 for the purpose of dealing in furnaces and oil, gas and electric appliances, etc. The incorporators are William F. Baxter, Walter Ackerman and L. D. Rockwell, of New York, N. Y.

UNITED STATES ARC LAMP COMPANY, of New York, N. Y., has been incorporated by F. Martin, H. P. Jones and E. J. Fordan, of 154 Nassau Street, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture and deal in arc lamps and lighting devices.

New Incorporations.

WALDENBURG, ARK.—Articles of incorporation have been filed for the Rice Belt Telephone Company by C. E. and A. M. Lashback and W. E. Burns. The company is capitalized at $25,000.

PALISADES, COL.—The Mutual Light, Power & Telephone Company has been chartered with a capital stock of $50,000 by H. L. Davis, H. R. Haugh and H. H. Younger.

WILMINGTON, DEL.—Articles of incorporation have been filed for the American Light, Heat & Power Company with a capital stock of $15,000,000 by Warren N. Akers, William J. Maloney and Mildred G. Taylor, all of Wilmington, Del.

TARPON SPRINGS, FLA.—The Polar Ice & Light Company has been chartered with a capital stock of $35,000. The officers of the company are: G. A. Louden, president and treasurer, and Ernest R. Meres, vice-president and secretary.

BOISE, IDAHO.—The Raymond Telephone Company of Bear Lake County has been incorporated with a capital stock of $10,000 by Thomas M. Mumford, George H. Hall and others.

OROFINO, IDAHO.—The Orofino Electric Company has been incorporated with a capital stock of $25,000 to build and operate electric power plants, etc. The incorporators are: K. G. Osterhout, T. Lister and J. H. Lister.

GRAND TOWER, ILL.—The Preston Union Telephone Company has been incorporated with a capital stock of $1,350 by J. T. Evans, Adam Lyrley and T. L. Aldridge.

GOSPORT, IND.—The Gosport Electric Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $10,000, and proposes to construct an electric plant and supply electricity for lamps and motors in Gosport and adjacent towns and cities. The incorporators are: Carl Keiffer, Charles Abrahams, Richard Howard and William J. Shroder, all of Cincinnati, Ohio.

WABASH, IND.—The Citizens' Telephone Company has been granted a charter with a capital stock of $25,000 to construct and operate telephone systems in Wabash and adjacent counties. The directors are: William F. Clupper, Frank Tobias, Eldo Cappoch and Cary Bowman.

ALBIA, IA.—The Albia Telephone Company has been incorporated with a capital stock of $10,000 by H. H. Sheriff, G. W. Gordon and J. S. Appleman.

FLUSH, KAN.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000 by Henry Noll, Edward Unscheid, Henry J. Floersch and others.

PRYORSBURG, KY.—The Pryorsburg Telephone Company has been chartered with a capital stock of $1,000 by Dr. M. W. Rossell, W. T. Rossell and Noblin Rossell.

PORTLAND, MAINE.—The New Hampshire Water & Electric Power Company has been chartered with a capital stock of $200,000 by John H. Pierce, John H. Ridge and Charles E. Gurney, all of Portland, Maine.

ALLENDALE, MICH.—The Allendale Telephone Company has been chartered with a capital stock of $4,000 by T. E. Hubbell, John J. Walbrink and J. Albert Hinken, of Allendale, Mich.

CALDERWOOD, MICH.—The Front Creek & Calderwood Telephone Company has been incorporated by Louis Anderson, of Calderwood, Mich., and George and Rosa L. Hardes, of Front Creek, Mich. The company is capitalized at $10,000, and proposes to operate a telephone and messenger service.

DUNDEE, MICH.—Articles of incorporation have been filed for the Farmers' Telephone Company with a capital stock of $10,000.

SANDSTONE, MINN.—The Clover Belt Telephone Company has been incorporated with a capital stock of $50,000 by J. H. Ingraham, Hugo Wickber, M. Bullis and others.

BILLINGS, MONT.—Articles of incorporation have been filed for the Billings Traction Company with a capital stock of $100,000 by C. J. Eddy, J. W. Patterson and J. A. Connolly, all of Muskogee, Okla.

KALISPELL, MONT.—The Pine Grove & Grand View Telephone Association has been incorporated with a capital stock of $5,000 by Fred Blair, E. D. Hopper and others. The company proposes to construct and operate a telephone line from Kalispell to Pine Grove.

COXSACKIE, N. Y.—The Coxsackie Flats Telephone Company has been chartered with a capital stock of $3,000 and the following directors: Michael Dolan, Herrick Sutfin, Fred Hallenbeck, George Van Schaack, Frank Jansen, and others.

FRIENDSHIP, N. C.—The Friendship Telephone Company has filed articles of incorporation with a capital stock of $5,000. Thomas Wakefield and others are the incorporators.

HUNTSBURG, OHIO.—The Huntsburg Telephone Company has been incorporated with a capital stock of $6,000 by G. A. Bartholomew and others.

MERCERVILLE, OHIO.—The Mercerville Union Telephone Company has been incorporated by J. N. M. Davis, E. L. Sheets, S. W. Williams and Samuel Lewis. The company is capitalized at $2,500.

NORWOOD, OHIO.—The People's Telephone Company has been incorporated with a capital stock of $10,000 by Henry Bentley and others.

OSTRANDER, OHIO.—The White Cross Telephone Company has been incorporated with a capital stock of $30,000 by J. W. Harsh and others.

BIG CABIN, OKLA.—Articles of incorporation have been filed for the Big Cabin Telephone Company with a capital stock of $5,000 by J. R. Stevenson, John Gearly and others.

HEWITT, OKLA.—The Darling Telephone Company has been incorporated with a capital stock of $3,000 by W. H. Darling, R. A. Donaldson and W. E. Darling.

JESTER, OKLA.—The Jester Telephone Company has been incorporated with a capital stock of $2,000 by W. F. Corder, A. W. Lock and L. J. McMinn.

DILLSBURG, PA.—A charter has been granted to the Dillsburg Light, Heat & Power Company, with a capital stock of $15,000. The company proposes to supply electricity in Dillsburg. The incorporators are: M. E. Kunkel, of Dillsburg, Pa.; J. J. Logan, of York, Pa., and others.

HARRISBURG, PA.—The Indian Queen Power Company has been incorporated with a capital stock of $5,000; directors are: Chesleigh H.

Briscoe, 187 Columbia Heights, Brooklyn, N. Y.; William P. Bray, of East Bangor, Pa., and Edwin C. Weller, of Portland, Pa.

SCENERY HILL, PA.—The Mariana & Scenery Hill Telephone Company has been chartered with a capital stock of $7,500 by J. W. Shidler, S. G. Fulton and C. Woonsetler, all of Marianna.

DOYLE STATION, TENN.—Articles of incorporation have been filed for the Doyle Telephone Company with a capital stock of $2,500 by R. E. L. Smith, Powell K. Lewis, Alonzo P. Johnson and others.

DALLAS, TEX.—The Dallas Standard Traction Company has been incorporated with a capital stock of $10,000 by E. L. Lancaster, J. B. Martin and R. A. Graves.

McALLEN, TEX.—The McAllen Ice & Light Company has been incorporated with a captial stock of $50,000 by A. L. Strang, C. T. Brown and George Quigstead.

BELLOWS FALLS, VT.—The Southern Vermont Light & Power Company has been incorporated with a capital stock of $50,000 to operate electric light stations. J. P. Meany, of Putney, Vt., is president, and D. Connors, of Bellows Falls, Vt., is treasurer.

REPUBLIC, WASH.—Articles of incorporation have been filed for the Kettle Valley Power & Electric Company with a capital stock of $500,000 by Henry B. Russell and Joseph Mony.

SPOKANE, WASH.—The Washington Consolidated Telephone & Telegraph Company has been incorporated with a capital stock of $1,000,000 by H. H. Reynolds, Fred Howe and others.

SPOKANE, WASH.—The Spokane, Portland & Northern Railway Company has been incorporated with a capital stock of $10,000,000 by E. P. Spalding and others. The company proposes to construct and operate an electric railway from Spokane to Nighthawk, near the international boundary.

MARLINGTON, W. VA.—The Ronceverte & Elkins Telephone & Telegraph Company has been incorporated with a capital stock of $50,000 by Homer N. Hutchinson, H. E. Nease, T. L. Burdette, B. F. Williams and A. M. Kincaid, all of Charleton, W. Va. The company proposes to erect and operate telephone and telegraph lines in Pocahontas County.

SHAWANO, WIS.—The Shawano Telephone Company has been chartered with a capital stock of $5,000 by E. A. Krueger, J. J. Steiger, John B. Gordon and King Weeman.

WINNIPEG, MAN., CAN.—The Manitoba Power Company has filed articles of incorporation with a capital stock of $5,000,000 for the purpose of generating and transmitting electricity for lamps and motors. The incorporators are: H. A. Lovett, of Montreal, Que., and others.

TORONTO, ONT., CAN.—The Interurban Telephone Company has been incorporated with a capital stock of $200,000 by J. S. Lovell, W. Bain, R. Cowans, H. Chambers and S. N. Mehr.

Personal.

MR. R. E. RICHARDSON, formerly manager of the Kansas City Electric Company, has been appointed general manager of the Commonwealth Power Company, Jackson, Mich.

MR. W. A. TORREY has resigned as manager of the Eddyville (Ia.) municipal electric light plant to become manager of the plant of the Avoca Electric Light & Power Company at Avoca, Ia.

MR. M. EKSTROMER presented a paper entitled "The Theory of the Storage Battery" before the commercial branch of the Denver Company Section of the National Electric Light Association at a recent meeting.

PROF. W. L. UPSON, formerly of the electrical engineering department of the Ohio State University, has been appointed professor of electrical engineering at the University of Vermont, Burlington, Vt.

MR. A. BEMENT, consulting engineer, Chicago, addressed the students and faculty of the College of Engineering of the University of Illinois at Urbana, Ill., on Oct. 22. His subject was "The Practical Uses of Coal Analysis."

MR. CHARLES K. MOHLER, consulting engineer, has opened an office at 1839 McCormick Building, Michigan Avenue and Van Buren Street, Chicago. Mr. Mohler is engineer for the Loop Protective and Improvement Association.

Mr. CHARLES C. BADEAU, electrical engineer of the Condit Electrical Manufacturing Company, of Boston, was a recent visitor in Chicago, addressing the members of the Electric Club of that city briefly at the weekly luncheon of Oct. 16.

MR. T. J. BALLARD, formerly of the electrical engineering staff of the municipal central station at Sheffield, England, has accepted a position with the Hydro-Electric Power Commission of Ontario, with headquarters at the City Hall, Toronto.

MR. V. C. GILPIN has been appointed general sales manager of the Eastern Flexible Conduit Company, 41-59 Gardner Avenue, Brooklyn, manufacturer of the non-metallic flexible conduit "Brook-Duct." Mr. Gilpin has also been appointed master of transportation of the National Electrical Contractors' Association.

MR. A. BOISSONNAS, of Geneva, head of a large group of electric power plants in Switzerland, recently passed through San Francisco. He is making a tour of the United States, studying our methods of producing and transmitting electric energy, and was accompanied on his Western trip by Mr. E. B. Tracy, of the banking firm of W. P. Bonbright, of New York, which is interested in electrical securities in the West.

MR. ALFRED CRAVEN, formerly deputy engineer of subway construction, has been appointed engineer in charge of subway construction by the New York Public Service Commission, to succeed Mr. George S. Rice. Mr. Craven is sixty-four years old, and was graduated from the United States Naval Academy in 1867. He has been engaged in engineering work since 1873, when he resigned from the navy. Up to 1884 he was a civil and mining engineer in California, but since 1884 he has been in New York, first with the Aqueduct Commission and since 1900 with the old Rapid Transit Commission and the Public Service Commission.

MR. CHARLES E. PHELPS, JR., who has become chief engineer of the Public Service Commission of Maryland, was chief engineer of the Electrical Commission of Baltimore from 1898 until 1910. Mr. Phelps was born on Jan. 31, 1871, in Baltimore and completed a course in electrical and mechanical engineering at the Johns Hopkins University in 1894. He served as superintendent of electrical construction for the David E. Evans Company from 1894 to 1898. After some private contract work in Pittsburg and Erie, Pa., and Wilmington, Del., for two years, he was appointed chief engineer upon the organization of the present electrical commission in Baltimore on Oct. 1, 1898. While chief engineer of the electrical commission he represented a number of cities in technical matters relating to electrical public service corporations principally. In 1906 he was selected by the National Civic Federation, together with Theodore Stebbins, of Boston, to conduct the investigation carried on by the federation into the question of municipal ownership and operation of public services.

MR. H. E. CHUBBUCK, of Peoria, Ill., general manager of the Illinois Traction System, is now vice-president executive of all the McKinley properties. This title, which is unusual, indicates the administrative authority of Mr. Chubbuck and the confidence reposed in him by Hon. William B. McKinley, of Champaign, Ill., who is president of the system and a member of Congress from the Nineteenth District of Illinois. The McKinley properties comprise street and interurban railways, electric light, district heating, gas and power transmission plants in Illinois, Missouri, Iowa and Kansas. A strong, well-poised, broad-gage man is needed for the management of such a system, and Mr. Chubbuck fills the requirements. He may be said to be an electrical man by inheritance, for his grandfather, S. W. Chubbuck, of Utica, N. Y., was a pioneer electrical inventor and lecturer, and his father, A. S. Chubbuck, established at Utica what is said to have been the first factory for the manufacture of telegraph instruments in the world. Mr. H. E. Chubbuck has been engaged in electrical pursuits all his life and has been twelve years with Mr. McKinley.

MR. JOHN S. BLEECKER, recently elected president of the Georgia National Electric Light Association Section, was born in Washington, D. C., April 8, 1878. He is the son of Rear-Admiral J. V. B. Bleecker, United States Navy, retired. After studying at the English High School, Boston, Mass., Mr. Bleecker graduated in the class of 1894, and then entered the Massachusetts Institute of Technology, from which he graduated in the class of 1898. He was employed in the mechanical department of the American Bell Telephone Company at Boston immediately after graduation, and until 1900, when he entered the service of the Stone & Webster Engineering Corporation, with which he has since remained. In the interest of this large holding system he has filled various capacities at Boston, Mass.; Seattle, Wash.; Houghton, Mich.; Blue Hill, Mass.; Paducah, Ky., and Columbus, Ga., the duties covering the wide range of lineman, motorman, inspector, clerk, superintendent and manager. At the present time he is manager of the Columbus Railroad Company, Columbus, Ga., one of the large public utilities of the South, operating the electric railway system as well as a central-station plant. Mr. Bleecker married Miss Parks, of Nashville, Tenn., and has two children. He is a member of the St. Anthony Club of Boston and the Muskogee Club of Columbus, and is extremely popular in the South, with whose interests he has thoroughly identified himself. He has taken a very active share in the work of the National Electric Light Association, has strongly advocated the formation of a State section for Georgia, and when steps were taken to create such a body he was the natural selection for president. Mr. Bleecker is a man of striking presence, standing 6 ft. 4 in. and weighing 210 lb., and is as well a good public speaker.

JOHN S. BLEECKER.

Obituary.

BRIG. GEN. DAVID PORTER HEAP, U. S. A., retired, who was United States representative to the Paris Congress of Electricians in 1881, died at his home in Pasadena, Cal., on Oct. 25, in the sixty-seventh year of his age. General Heap graduated from the United States Military Academy in 1860 and was appointed first lieutenant of engineers. He was promoted rapidly, reaching the rank of colonel in 1903 and being raised to that of brigadier general in the latter part of the same year. Throughout

his military career he was connected with the engineering branch of the service. During the Civil War he was engaged in river and harbor fortifications, and later, when he was chief of the Pacific division of engineering, he was identified with the lighthouse improvements. Among the books he wrote are "Ancient and Modern Lighthouses," "Electrical Appliances of the Present Day," "History of the Application of Electricity to Lighting the Coasts of France" and the report of the International Exhibition of Electricity in Paris. General Heap was twice married. He married Miss Elizabeth Brown Beal in 1875. She died in 1889, and three years later he married Miss Josephine Bigelow Wright, who survives him.

Trade Publications.

CENTRIFUGAL AIR COMPRESSORS.—The General Electric Company has superseded its old bulletin on "Centrifugal Air Compressors for Industrial Air Blast and Exhauster Service" by Bulletin No. 4774.

THOMSON HIGH TORQUE INDUCTION TEST METER.—The General Electric Company has recently issued Bulletin No. 4773, entitled "Thomson High Torque Induction Test Meter, Type IB-4." This bulletin supersedes the previous bulletin on this subject.

CONNECTORS.—Dossert & Company, 242 West Forty-first Street, New York, have issued an eight-page folder which illustrates and describes a number of new specialties, particularly a new type of anchor connector for use with strain insulators and a new insulated cover for cable taps.

ISOLATED PLANT COMBINATION GENERATOR AND FEEDER PANELS.—Bulletin No. 4763, entitled "Isolated Plant—Direct-Current Combination Generator and Feeder Panels," recently issued by the General Electric Company, supersedes the previous bulletin issued by this company on that subject.

POLYPHASE MAXIMUM WATT-DEMAND INDICATOR.—Bulletin No. 4768B of the General Electric Company has for a subject Type W polyphase maximum watt-demand indicators, which are particularly applicable to motor installations where it is necessary to record the maximum load irrespective of power-factor and voltage fluctuations.

TANTALUM INCANDESCENT LAMPS.—The General Electric Company has recently issued a bulletin (No. 4766) describing the GE tantalum incandescent lamp for general illumination. It illustrates and describes lamps for 100 volts to 125 volts and 200 volts to 250 volts, compares the cost and efficiency of these lamps with those of the carbon and Gem lamps, and contains data of use to those interested in the subject.

TRAIN LIGHTING WITH METALLIC FILAMENT LAMPS.—Bulletin No. 4769, entitled "Train Lighting with G-E Mazda and Tantalum Lamps," should be of interest to all connected with this branch of transportation. Owing to the high efficiency of these lamps they are admirably adapted to this service, while the strong filament of the tantalum and the flexible mount of the tungsten filament render them capable of withstanding the sudden jars and shocks incident to railway service.

ESTERLINE METERS.—The Esterline Company, Lafayette, Ind., has issued a 32-page catalog describing and illustrating in full detail the various types of graphic meters of its manufacture, which cover practically the entire field of electrical industry. The instruments are made in four types, namely, switchboard, wall, desk and portable, and include voltmeters, ammeters, watt-hour meters, speed-recorders and recording pyrometers.

MODERN STREET LIGHTING.—"Modern Street Lighting by Luminous Arc Lamps" is the title of an attractive booklet (B-3014) just issued by the General Electric Company, which is devoted to the subject of street lighting by the General Electric series luminous-arc rectifier system. The vertical carbon flame arc lamp is illustrated and briefly described. The station equipment required for this system is mentioned, and a list of cities in which the system has been installed is given.

ELECTRIC VEHICLES.—The Ohio Electric Car Company, Toledo, Ohio, manufacturer of high-grade electric automobiles, has issued a handsome new catalog describing and illustrating its distinctive line of electric vehicles. Features of these machines are the motor control through magnetic contactors manipulated from a compact dial switch mounted on the steering handle. The chassis embodies the gasoline-car standard of construction as to strength and weight. The car utilizes a shaft drive without universal joint.

SINGLE-PHASE INDUCTION MOTORS.—Bulletin No. 4775, issued by the General Electric Company, entitled "Type KS Single-Phase Induction Motors," describes a motor offered by the General Electric Company to meet the power requirements of establishments which, for some reason, are unable to secure other than single-phase current. This motor is, in general, adapted to drive geared and belted machinery requiring constant speed with light or moderate starting torque. It is made in capacities of from 1 hp to 15 hp, and wound for 110 volts or 220 volts, 60 cycles.

BELT-DRIVEN GENERATORS.—The Westinghouse Electric & Manufacturing Company has just issued a circular (No. 1161) on the subject of its Type G, belt-driven, alternating-current generators. These generators are especially designed to meet the needs of industrial plants and smaller central stations and have proved very successful in this class of service. Simplicity of electrical and mechanical construction and economy in operation and maintenance are stated to be the proved characteristics of these generators.

SWITCHBOARD INDICATING METERS.—The Westinghouse Electric & Manufacturing Company has just issued a circular (No. 1098) on the subject of switchboard indicating meters in which are described and illustrated direct-current and alternating-current indicating meters, including frequency meters and power-factor meters, synchroscopes and instrument transformers. It is pointed out in the circular that with the development of switchboard design has come the necessity for various types and forms of indicating meters, each adapted to its own peculiar purpose. Meters amply accurate for one class of service might prove entirely unsuited for another service, while high-grade meters are in general too expensive for use where accuracy is not of prime importance. With the introduction of meter or control boards forming units separate from the switching apparatus and busbars, a need has arisen for meters with long scales and long-distance readability. The organization of large power developments has necessitated the introduction of the edgewise type of meter, which occupies small space and yet retains the long scale necessary for accurate legibility. For these uses meters of high accuracy are essential. On the other hand, for small power plants, battery-charging plants and similar installations a cheaper instrument will serve the purpose admirably.

WAVERLEY ELECTRICS.—The 1911 catalog of the Waverley Company, Indianapolis, is fully up to the high standard of automobile trade publications, which in design and execution stand easily at the head of this class of literature. The catalogue is 9 x 14 in. in size, printed on heavy enamel paper, and bound in imported hand-made cover stock of a rich mottled brown. On the second cover page is mounted a photogravure representing a Waverley open carriage driven by a little girl of four in a park, the brown tones of the photogravure on Japanese vellum harmonizing well with the cover stock. The illustrations include thirteen full-page half-tones, representing Waverley 1910 models, with backgrounds illustrating prominent buildings and park scenes in the leading American cities. These backgrounds have been ruled down by a new process of halftone work in such a manner that the cars stand out with unusual prominence and give the effect of two separate printings in gray and black. Expert printers and engravers may well be deceived by these plates, as it is remarkable that the effect can be obtained in one impression. In addition to these thirteen pages there are a high-light half-tone on page 19, a ghost picture on page 21, and a two-toned half-tone on page 22, each of which is a successful handling of a difficult problem. The composition and press work are as praiseworthy as the illustrations, while the initials and printer's ornaments, though sparingly used, add much to the artistic effect of the whole.

BUSINESS NOTES.

THE EDISON STORAGE BATTERY COMPANY and the Federal Storage Battery Car Company have opened a joint office at 193 Michigan Avenue (McCormick Building), Chicago. Messrs. W. W. Wheatly and Lucian Wheatly are in charge.

MR. W. P. CARSTARPHEN, JR., of Denver, has developed and is now marketing a very complete line of panel boards and cabinets which has met with a large use in adjacent territory because of quick delivery and ready adaptation to any desired uses.

THE TOLEDO CARBURETOR COMPANY, of Toledo, Ohio, has recently increased its capital stock from $1,000 to $75,000, and proposes to handle a new carburetor invented by a Cleveland man and manufactured by the Kinsey Manufacturing Company, of Toledo. Isaac Kinsey, of the Kinsey Manufacturing Company; W. G. Nagel, of the W. G. Nagel Electric Company, and Frank Collins, of the National Supply Company, are interested in the company.

THE DI-EL-ITE MANUFACTURING COMPANY, of Philadelphia, makers of rheostats, insulating joints, "dimalites," etc., has changed its name to the Wirt Electric Specialty Company. No change in the management will be made and no change in the business or policy of the company, except in the direction of increased facilities. Large premises have been secured at Armat and Lena Streets, where the company has four times its former floor space, and equipment to do four times the former business.

MR. ADOLPHUS BUSCH, purchaser of the American Diesel Engine Company, St. Louis, Mo., has been making inquiries relative to the efficiencies shown by the Diesel engine in electric central stations and other plants. Figures as low as 4 mills per kw-hour at the switchboard have been reported. The Prairie Pebble Phosphate Company, Mulberry, Fla., reports that it has been operating seven 300-kw, 2300-volt, 60-cycle alternators driven by Diesel engines in parallel for over two years. An eighth engine was ordered and the company is now negotiating for a ninth engine of the same kind. Among central stations using the Diesel engine are the following: Sherman Gas & Electric Company, Sherman, Tex.; South Norwalk Electric Works, South Norwalk, Conn.; Board of Public Service, Bellefontaine, Ohio; Atlantic Light & Power Company, Coeymans, N. Y.; Effingham Electric Light & Power Company, Effingham, Ill.; Morgan City Electric Company, Morgan City, La. As is probably well known the Diesel engine uses crude or fuel oil and the maker guarantees a fuel consumption not to exceed 8 gal. when running at any load between half-load and rated capacity for each 100 net effective hp-hours. Very close regulation has been shown by plants in operation. A feature of the engine is that the fuel is not used explosively, which eliminates igniters. At present Diesel engines are built in sizes ranging up to 225 hp in the three-cylinder type, and up to 450 brake hp in the six-cylinder type.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Third annual convention, Anniston, Ala., Nov. 21, 22 and 23, 1910.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, Engineering Societies Building, 29 West 39th St., New York. Next meeting (semi-annual), Chicago, Nov. 14, 15 and 16, 1910.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting, New York City, April or May, 1911.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia.

American Street & Interurban Railway Engineering Association. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

American Street & Interurban Railway Association. Secretary H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, John Farrington, Steubenville, O.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting, Boston, Mass., June 1911.

Association of Railway Electrical Engineers. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting, Chicago, November, 1911. Semi-annual meeting, Washington, 1911.

Association of Edison Illuminating Companies. Secretary, N. T. Wilcox, Lowell, Mass.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Dayton, Ohio, Dec. 1, 1910.

Chicago Electrical Show. Manager, H. E. Niesz, 150 Michigan Boulevard, Chicago. Next show, Jan. 7-21, 1911.

Colorado Electric Light, Power & Railway Association. Acting Secretary, F. D. Morris, 323 Hagerman Bldg., Colorado Springs, Col.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle Association of America. Secretary, Harvey Robinson, 124 West Forty-second Street, New York.

Electric Club, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabasah Ave.

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., Jan. 17, 1911.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

Engineering Society of Wisconsin. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

Engine Builders' Association of the United States. Secretary, C. H. Lembower, Reading, Pa.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April 4 and 5, 1911.

Illinois State Electrical Association. Secretary, H. E. Chubbuck. Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Chicago, 1911.

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntington, Ind.

Indiana Electric Light Association. Secretary, J. V. Zartman, Indianapolis, Ind.

Internal Combustion Engine Association. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Next meeting, St. Paul, Minn., 1911.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April 19, 20 and 21, 1911.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Building, Des Moines, Ia. Annual meeting, second Wednesday in March each year.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. 21 and 22, 1911.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

Maine Electrical Association. Secretary, Fred D. Gordon, Auburn, Maine.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. P. Biggs, Detroit, Mich.

Minnesota Electrical Association. Secretary, B. W. Cowperthwait, Faribault, Minn.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Railway & Light Company, Jackson, Miss.

Missouri Electric, Gas, Street Railway & Water Association, Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo. Next meeting, St. Louis, May, 1911.

National Arm, Pit & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electric Light Association. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

National Electric Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

National Electrical Credit Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

Nebraska Electrical Association. Secretary, Frank McMaster, Beatrice, Neb.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, National Electric Light Association. Secretary, L. D. Gibbs, 39 Boylston St., Boston, Mass.

New Orleans Electrical Contractors' Association. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn; Ohio State University, Columbus, Ohio. Next meeting, Nov. 18 and 19, 1910.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Atlantic City, N. J., 1911.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Building, Chicago, Ill.

PACIFIC COAST ELECTRIC VEHICLE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY, Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburg, Pa. Meetings, fourth Monday of each month.

RAILWAY ELECTRIC SUPPLY MANUFACTURERS' ASSOCIATION. President, A. C. Moore, Safety Car Heating & Lighting Co., Chicago.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 25, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

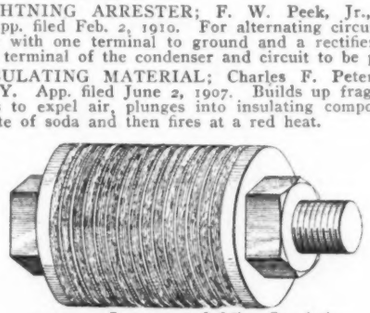
973,478. TRACK INSTRUMENT; C. A. Coolidge, Portland, Ore. App. filed Dec. 27, 1909. Operated by the wheel of the train to throw a lever in a horizontal direction to close the electrical signal circuit and then in a vertical direction to open the circuit.

973,508. POTENTIAL SWITCH; J. D. Ihslder, New York, N. Y. App. filed Apr. 9, 1906. A pivoted switch lever, a manual lever for operating it and movable relatively thereto, an electro-magnetic locking device for controlling the switch and a circuit closer operated by the manual lever.

973,525. MOTOR CONTROLLER; W. B. Lucas, Chicago, Ill. App. filed Mar. 10, 1909. A drum for motor controllers which is hollow to contain a liquid which when driven at a given speed short-circuits contacts within the drum.

973,555. LIGHTNING ARRESTER; F. W. Peek, Jr., Schenectady, N. Y. App. filed Feb. 2, 1910. For alternating circuits including a condenser with one terminal to ground and a rectifier connected to the other terminal of the condenser and circuit to be protected.

973,557. INSULATING MATERIAL; Charles F. Peterson, Schenectady, N. Y. App. filed June 2, 1907. Builds up fragments of mica and heats to expel air, plunges into insulating compound of kaolin and silicate of soda and then fires at a red heat.



973,557.—Impregnated Mica Insulation.

973,560. TERMINAL FOR ELECTRICAL APPARATUS; W. B. Potter, Schenectady, N. Y. App. filed Sept. 7, 1907. An air-tight casing containing a tapering tube and a conducting member passing through the tube and having a resilient tapered portion.

973,565. MEANS FOR VENTILATING DYNAMO ELECTRIC MACHINES; Henry G. Reist, Schenectady, N. Y. App. filed Oct. 26, 1906. A machine with stator and rotor and a casing closed at one end, the stator having channels through the interior leading from one end of the casing, with means for forcing the air through the channel.

973,567. SIGN RECEPTACLE FASTENING; F. J. Russell, New York, N. Y. App. filed Oct. 9, 1908. A supporting element with a receptacle body having a depression in wall, a fastening device engaging with the depression and with the supporting element and holding the receptacle when the latter is inserted through the support into the fastener.

973,568. SIGN RECEPTACLE FASTENING EYELET; F. J. Russell, Brooklyn, N. Y. App. filed Oct. 26, 1909. A support, a receptacle with a collar and a fastener engaging the collar and in the receiving hole of the support.

973,575. MOTOR CONTROL; W. I. Slichter, Schenectady, N. Y. App. filed June 23, 1909. The method of operating a plurality of electric motors mechanically connected to drive a common load and connected electrically in a plurality of groups by starting the motors by impressing reduced voltages on the groups and varying the connections alternately to increase the impressed voltage.

973,579. VOLTAGE REGULATOR; C. P. Steinmetz, Schenectady, N. Y. App. filed June 9, 1909. For regulating the voltage of a three-phase, Y-wound transformer by regulating one phase independently of the others by adding a regulating voltage to the voltage to be regulated, the former being in quadrature with the voltage of the adjacent phase so as not to affect it.

973,586. ELECTRICAL WELDING OF SHEET METAL; E. Thomson, Swampscott, Mass. App. filed Oct. 21, 1909. Welding by isolated spots by forming tongues in the body of the sheet, bending them onto the surface, superposing the sheets and applying an electric current and pressure.

973,590. ELECTRIC BRAKING; J. F. Tritle, Schenectady, N. Y. App. filed May 2, 1910. An electric motor with a source of current therefor and means for causing it to act as a braking generator for returning the energy to the source by separately exciting the field of the motor and automatically compounding the excitation to compensate for varying speeds.

973,592. SOLDERING IRON; T. Van Aller, Schenectady, N. Y. App. filed July 17, 1908. The point of the iron is electrically heated by means of a resistance conductor formed into a flat heating unit within a slot in the point of the iron.

973,593. ELECTRIC FLAT IRON; T. Van Aller, Schenectady, N. Y. App. filed Feb. 18, 1909. Includes a body with a narrow resistance strip extending flatwise around its outer portion adjacent to the edge and in heat conductive relation therewith, secured thereto by a metallic plate covered with a removable cover.

973,613. CIRCUIT CONTROLLER; W. A. Atwood, Schenectady, N. Y. App. filed Feb. 16, 1909. Disconnecting switches with the two adjacent terminals bridged by a fuse carried on a movable member, or insulating support mounted upon an arm.

973,625. EXHAUSTING MACHINE; W. R. Burrows, Newark, N. J. App. filed May 11, 1906. For incandescent lamps. Two pumps are connected to a valve which communicates with the bulb, the valve being automatically operated to connect the bulb to the pumps in succession and the filament being caused to glow while the bulb is connected to one pump.

973,627. ELECTRICAL ALARM SYSTEM; Frank Castle, Auckland New Zealand. App. filed June 8, 1910. A fire alarm; the building containing a local circuit which communicates with a central station. Two relays are at central, and each inserted with the closed circuit, one relay of greater resistance than the other so that the current of the closed circuit is prevented from flowing through it, this relay closing a local indicator alarm circuit while the armature of the weaker relay closes a separate local indicator circuit for faults.

973,633. LINEMAN'S CHAIR; J. W. Davis, San Antonio, Texas. App. filed Mar. 19, 1910. A plurality of frames carrying a cross sheet to the upper part of which rollers are secured which run on the line wire.

973,644. AEROPHONE; L. DeForest, New York, N. Y. App. filed Nov. 12, 1909. Wireless telephone, including a singing arc circuit for creating oscillation in the aerial with means for varying amplitudes by sound waves acting through a transformer.

973,645. LIGHTNING-ARRESTER; Frank T. Forester, Schenectady, N. Y. App. filed Feb. 10, 1909. Electrolytic lightning arrester consisting of an aluminum cell, the plates being suspended from the cover and secured out of contact with each other without using spaces within the body of the electrolyte.

973,653. ARC LAMP; C. A. B. Halvorson, Jr., Saugus, Mass. App. filed Jan. 28, 1909. An arc lamp with weldable electrodes which are forcibly struck together and then separated, the arcing face of one electrode being tilted by the blow.

973,657. HIGH POTENTIAL SWITCH; E. M. Hewlett and T. E. Button, Schenectady, N. Y. App. filed Jan. 7, 1902. A driving motor for the switch which strains a spring for throwing the switch and a clutch for connecting the motor, and operating means which are disconnected when the springs are put under compression.

973,672. CURRENT COLLECTOR FOR ELECTRICALLY PROPELLED VEHICLES; W. Kohler, Bremen, Germany. App. filed March 17, 1910. A traveling current collector carrying a connecting cable forming a loop mounted in arms pulled together by a spring.

973,676. ANNUNCIATOR; A. Lungen, New York, N. Y. App. filed Nov. 20, 1909. A sheet metal keeper carries the magnet, armature and shutter, portions of the keeper being struck up to limit the movement of the shutter and armature.

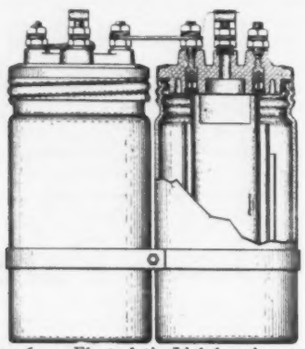
973,685. ARTIFICIAL SKYLIGHT; D. McF. Moore, Newark, N. J. App. filed Oct. 27, 1903. An electric tube lamp for photographers' use with conducting caps for terminals, the tubing being doubled back and forth and multiple tubes arranged in the spaces.

973,703. INCANDESCENT ELECTRIC LAMP; T. E. Robertson, Catford, England. App. filed Nov. 2, 1908. The filament loops are supported intermediate to their ends by extensible elastic anchors capable of transverse movement to compensate for thermal changes.

973,732. PROCESS OF REDUCTION OF ORES CONTAINING SULPHUR AND IRON; Arnold Wiens, Bitterfeld, Germany. App. filed Feb. 27, 1909. Method of reducing ores containing iron and sulphur by smelting the ore in the presence of silica and carbon by an electric current, the silica eliminating the sulphur.

973,736. PRODUCTION OF LIGHTING EFFECTS ON STAGES BY MEANS OF HIGH-TENSION CURRENTS OF HIGH FREQUENCY; Camilla Feher Zhaniel, Charlottenburg, Germany. App. filed July 7, 1909. Impregnates theatrical garments with powdered conducting material and then introduces these articles into high-tension currents or fields.

973,737. DEVICE FOR CONTROLLING THE CONSECUTIVE OPERATION OF ELECTROMAGNETS; F. G. Agrell, Stockholm, Sweden. App. filed Feb. 27, 1907. For consecutively operating electromagnets or relays by means of a series of releasable members which perform a mechanical operation and a series of co-operating members with means for moving a number of the releasing members.



973,645.—Electrolytic Lighting Arrester.

973,747. FULL SOCKET; T. H. Brady, New Britain, Conn. App. filed March 18, 1909. An insulating block, a rotatable spindle, an oscillating driving member, a rotary driven member held against the driving member and resilient contacts on the driven member.

973,762. SELECTOR SWITCH; E. B. Craft, Chicago, Ill. App. filed Nov. 23, 1907. For automatic telephone exchanges, including a rotating shaft with a series of contact brushes, a disk armature carried by the shaft, an electromagnet with an annular core concentric with the shaft to attract the armature.

973,772. VESSEL LOADING ALARM; J. Gedeon, Cleveland, O. App. filed June 30, 1909. Indicates when the draft of the vessel reaches the desired depth by means of a vertical tube which can be adjusted in a standpipe located within the hull of the vessel, in accordance with the draft and a float in the tube for controlling the electric circuit.

973,776. PROCESS OF EXTRACTING METALS FROM THEIR ORES; W. E. Greenawalt, Denver, Colo. App. filed May 25, 1909. Treats copper ore with an acid chlorid solution, electrolyses, subdivides and then brings the liberated chlorium in contact with the solution in the presence of sulphur dioxide and returns the regenerated acid solution to the ore and repeats the cycle.

973,898. SIGNALING SYSTEM; E. Parsons, Chicago, Ill. App. filed Aug. 20, 1908. A plurality of signal receiving and sending stations on the same line with means for selectively calling any station. Details.

973,817. SIGN RECEPTACLE FASTENING EYELET; F. J. Russell, Brooklyn, N. Y. App. filed Oct. 26, 1909. A body with a front shoulder, an intermediate shoulder, a supporting element with an integral eyelet receiving the receptacle body and engaging between the two shoulders.

973,826. ELECTRICAL OSCILLATOR; F. K. Vreeland, Montclair, N. J. App. filed Dec. 15, 1906. An oscillating circuit, a vacuum tube and means for producing an axial magnetic field for directing and concentrating the cathode blast, so as to vary conductivity of the gas.

973,836. BRUSH FOR DYNAMO ELECTRIC MACHINES; H. L. Zabriskie, Brooklyn, N. Y. App. filed Aug. 19, 1908. A carbon brush block with a recess containing a metallic conductor through to a plate or cap and a non-conducting block upon the brush block and secured thereto by the metallic cap plate.

973,838. COIL FOR ELECTROMAGNETS; C. Aalborg, Wilkinsburg, Pa. App. filed June 4, 1906. A magnet coil including a tubular member with cross webbs through the center and lateral slots across the sides connected by the web and diagonal slots across the ends.

973,878. ELECTRIC MOTOR; E. S. Pillsbury, St. Louis, Mo. App. filed May 14, 1910. A laminated field pole, the thickness of the individual laminæ being different on two sides thereof for single-phase motors, so arranged as to exert a starting torque upon the armature.

973,883. PRODUCTION OF INCANDESCENT ELECTRIC LAMP FILAMENTS; Waldemar Ruhling, Berlin, Germany. App. filed Nov. 15, 1909. Carbon filament with coating of antimony for low-current work.

973,885. CURRENT CONTROLLER; F. L. SESSIONS, Columbus, O. App. filed Jan. 7, 1904. Current switch and resistance controller with oppositely wound blow-out magnets with their coils in parallel with the resistance.

973,889. ELECTRICAL CIRCUIT BREAKER; H. R. Stuart, Wilkinsburg, Pa. App. filed Feb. 6, 1906. A movable switch arm operated by toggle levers with means co-operating directly with one of the toggle levers to retain the circuit breaker in closed position and a loosely mounted lever having an arm for directly engaging the joint between the toggle levers to close the lever and for engaging the retaining means to grip the breaker.

973,898. BINDING POST; A. F. Wallbillich, Bridgeport, Conn. App. filed June 22, 1910. Switch contact and binding post with vertical frame and offset blade, the frame receiving the binding screw and supporting legs forming a wire channel with the frame for receiving the binding screw.

973,913. FLASH-LIGHT SIGNALING APPARATUS; G. H. Butterworth and E. Veevers, Liverpool, England. App. filed Feb. 19, 1909. A lamp and a screen intermittently flashed by means of an electromagnet or solenoid located above the lamp which drops the tubular screen over the lamp and removes it intermittently.

973,924. CIRCUIT BREAKER; J. C. Dow, Wilkinsburg, Pa. App. filed July 13, 1907. An improved release mechanism for a double-pole manual circuit breaker tripped by an electromagnet, operating through a bell crank.

973,926. ELECTRIC BRAKE; R. R. DUNLOP, Columbus, O. App. filed Jan. 17, 1905. Electromagnetically operated brake for conveyors, including a shunt-wound dynamo operating as a motor or generator with a brake for controlling its speed controlled by an electromagnet.

973,938. CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed Dec. 14, 1908. Switchboard on which a two-pole circuit breaker is operated through bell crank and solenoid magnet and released by a latch operated by a solenoid trip magnet.

973,951. ELECTROPLATING PROCESS; Francis J. McElhone, Jersey City, N. J. App. filed June 9, 1906. For electrotypes by treating the graphite covering for type mould with an organic acid and electroplating thereafter.

973,971. GAS LIGHTING APPARATUS; M. Primeau and G. McCullagh, Winnipeg, Manitoba, Canada. App. filed Dec. 6, 1909. Portable igniter with battery in the handle and a movable contact controlled by the finger.

973,982. PULL SOCKET; R. A. Schoenberg, New York, N. Y. App. filed Apr. 27, 1910. Binding posts with separate centers and side contacts and fixed spring contacts, and a chain rail carrier having a spring contacting with and co-operating with the chain.

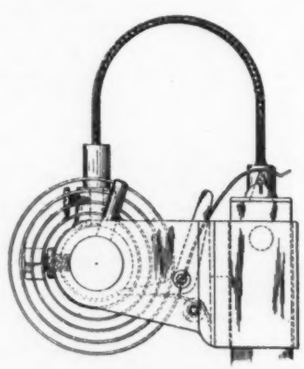
973,984. MAGNETIC ORE SEPARATOR; C. A. Sellon, Halleck, Cal. App. filed Nov. 16, 1909. For magnetically separating gold, etc., from sands by means of a sluice box, a magnetic plate being arranged in the bottom of the trough with magnets on the plate.

973,997. METHOD OF OPERATING VAPOR ELECTRIC DEVICES; P. H. Thomas, Montclair, N. J. App. filed Jan. 27, 1905. Single-phase alternating vapor lamp with two negative electrodes and two positive electrodes, the positive electrodes being supplied with alternating current sufficiently strong to operate through either negative electrodes and the negative electrodes having applied to them an alternating e.m.f. to break down the negative electrode reluctance and cause separation of the negative electrode.

974,008. ELECTRODE; R. H. Wolff, New York, N. Y. App. filed Jan. 14, 1910. Forms several parts of a carbon electrode for electro-metallurgy so that one part can be inserted into another to be retained therein and fills the spaces with suitable material.

974,016. HOLLOW CARBON ELECTRODE FOR GALVANIC ELEMENTS; S. Benko, Budapest, Austria-Hungary. App. filed Jan. 19, 1909. The carbon electrode has a metal casing with a space between the metal and the carbon filled by an electrolyte under pressure to pass into the pores of the carbon doing away with the metal contacts or binding screws on top of the carbon.

974,029. ELECTROLYTIC CONDENSER; E. E. F. Creighton, Schenectady, N. Y. App. filed Oct. 26, 1907. A plurality of aluminum plates, disk-shaped. and nesting together and partially filled with electroltye, with insulating supports for the plates and an insulating washer between the plates.



973,836.—Brush for Dynamo Electric Machines.

974,037. MERCURY VAPOR LAMP; L. E. Dempster, Schenectady, N. Y. App. filed March 27, 1905. Mercury electrode, a plunger floating in the mercury, a body of conducting liquid carried by the plunger and insulated from the mercury, a filament in the liquid and electromagnet for moving the mercury to establish momentary contact.

974,047. LIFTING MAGNET; C. E. Frederickson, San Francisco, Cal. App. filed June 11, 1910. Three-pole solenoid magnet in a copper water-tight case, held in a saddle or cage so that it may be dropped into the well to lift drill rods and tools.

974,063. SYSTEM OF ELECTRICAL DISTRIBUTION; A. S. Hubbard, Greenwich, Conn. App. filed Feb. 20, 1902. For overcoming insensitivity of the regulating dynamo used with storage battery plants by means of an induction device responsive to electrical fluctuations on the distribution circuit and causing similar fluctuations in the battery.

974,103. SIGNALING APPARATUS FOR AIRSHIPS AND THE LIKE; P. Lentz, Gross-Lichterfelde, near Berlin, Germany. App. filed Apr. 5, 1910. Gives a bell signal electrically by means of a rotating vane wheel driven by the air as the airship rises or falls, thus informing the pilot whether his airship is rising or falling.

974,106. ELECTRICAL SWITCH; A. F. Furbush, Cliftondale, Mass. App. filed July 7, 1910. For sewing machines and the like. A plate carries a fuse for overloads inserted into clips and a spring-pressed circuit breaker tensioned by the treadle breaks the circuit when it is desired to stop the motor.